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### A GOOD EXPORT YEAR.

The figures just available for June, completing the fiscal year of the government, show a very satisfactory condition as to export trade in general and more particularly in regard to electrical exports. In a general way the month itself maintained the advance of the year. The exports of heavy electrical machinery were $825,091, as compared with $586,202, and the exports of electrical instruments and apparatus were $884,839, as compared with $902,503, or a total of $1,709,930, against $1,488,705 in the previous June. The latter average if kept up through the year would mean over $20,000,000, while, as a matter of fact, exports reached $18,727,455. This, however, was a gain of $3,985,060 over 1910. If we could look for an annual increase of $4,000,000 in such exports, which has been had now for two successive years, electrical manufacturers might fairly congratulate themselves.

Looking a little into the details for the year, it is seen that the exports of heavy goods in 1910-11 were $8,024,028, as compared with $6,048,263 in 1909-10, while the exports of instruments, etc., were $10,702,827, as compared with $8,694,132, an increase of nearly $2,000,000 in each class, while, as before, the smaller lines of apparatus are shown to be the more marketable. As to customers, England and France remain among the smallest, with actual declines, while the trade with Germany and Italy is so small as not to appear separately in the returns. Canada looms up splendidly and it will be interesting to see what reciprocity will do in this respect. She took $4,912,189 as against $3,557,954 in the previous year, and it will be noted that the aggregate is 25 per cent of the total electrical exports. Here is certainly a friend and customer to cultivate. But Japan, Mexico and Brazil are also excellent consumers of our electrical wares, taking as follows in 1910-11: Japan, $2,215,173; Mexico, $2,468,888; Brazil, $2,446,041, a total of $7,130,102, or nearly 30 per cent of the trade. Hence it may be said that four countries take about half of our electrical exports. It would seem that some of the others might come in time to the same level if sedulously cultivated, for outside of Europe the conditions of demand and opportunity appear to be pretty much the same everywhere. Of course, when money is secured in any European country for a new trolley or lighting system in Asia or South America or a telephone exchange in Africa it is likely that the apparatus will be bought in the country that is investing, but we can also undertake such financial deals and may be in them again when there is any genuine revival of trade and speculation. Meantime we may regard ourselves as more than holding our own in the markets of the world with a miscellaneous electrical trade over the counter.

**THE CALCULATION OF CAPACITIES OF PARALLEL SUSPENDED WIRES.**

When a condenser is formed, say, of a square sheet of glass, coated on its faces with tinfoil sheets, and a difference of electric potential, as from storage-battery terminals, is applied to the coatings, the glass is subjected to electric stress exerted through the sheet. Electricity is either actually or virtually driven through the sheet, but only by an elastic yield, assuming perfect insulation in the glass. If we double the impressed potential difference we double the elastic electric transfer. The quantity of electricity which is elastically transferred with unit-impressed potential-difference is a measure of the yieldingness of the glass slab to the stress and is called the capacity of the condenser. The capacity, in the case of a slab condenser, varies directly with the coated surface area and inversely as the thickness. Quantitatively, simple as the capacity of a condenser is, when formed of a dielectric slab, the capacity of a dielectric mass of more complex geometrical form is so difficult to ascertain that only about twenty of the very simplest cases, out of the infinite possible number, have yet been worked out mathematically.

Fortunately, some of the most frequently recurring practical cases of capacities are comprised in those that have been worked out. Among these is the very common case of the capacity of a pair of parallel conducting aerially insulated wires uniform in size and separation. The linear capacity of such a pair or wires, far from the ground and from other wires, has a well-known and relatively simple algebraic expression. When, however, we bring other wires into the vicinity of our first pair, or when we bring the surface of the ground into active consideration, the problem becomes much less simple. The general theory of it was first published by Clerk-Maxwell about fifty years ago, but in a form which did not lend itself readily to computation. Mr. Oliver Heaviside, about thirty-five years ago, brought out a modification of the Maxwell theory which was a little more amenable to arithmetical treatment, and he worked out a few examples.

In the article commencing on page 386 of this number Mr. Frank F. Fowle applies the Maxwell-Heaviside theory to a number of interesting practical cases, and the numerical results which he obtains are of great practical value. In the first place, the article shows that the capacity of a pair of metallic-circuit wires is so slightly affected by the presence of the conducting ground, or the presence of other metallic circuit wires in the neighborhood, that the difference is for ordinary distances practically negligible. This fact, indeed, has long been published. Secondly, a number of new interesting cases are worked out of three and four wires in various generally used groupings. It is shown, for example, that three wires, spaced on the edges of an equilateral prism 5 ft. wide and 25 ft. above ground, will have practically balanced capacities, if operated star three-phase, with the generator neutral disconnected; whereas, if the generator neutral be grounded, the capacity of the uppermost wire becomes less than that of the others and the charging currents of the system become unbalanced, unless the wires are systematically transposed. Another valuable result worked out in the article is the reduction in the effective capacity of a phantom telephone circuit as compared with its resistance and the constants of the two component loops. The article can safely be regarded as the best piece of numerical work that has appeared on this subject for a long time.

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**STREAM FLOW AND FORESTRY.**

In another column we present an interesting communication from Professor Mead concerning our recent comment on the data in his important *Bulletin* on deforestation and stream flow. We should ordinarily make very brief further comment, as it is eminently proper for an author to reinforce his case in such wise. As the matter is of large public interest, however, it seems worth while again to call attention to it. Professor Mead's criticism is, in effect, that the fifteen-year periods which we compared would give materially different results were they extended to sixteen or seventeen years, which results he presents. The discrepancy, such as it is, is wholly due to the fact that the years 1888 and 1889, the sixteenth and seventeenth years, were respectively years of extraordinarily high and extraordinarily low water, so that their effect upon the average is relatively large. The conclusions as regards low water remain essentially unchanged whichever period is taken; but the thirty-four days of flood in 1888 shift the totals conspicuously according as they are included in one or the other period. Now, we may first remark that these very unusual years fall well into the period of extremely heavy forest cutting in Wisconsin. The deeper one goes into this period obviously the less striking the differences between the initial and final stages would be if there were a marked effect due to deforestation.

Even a more striking comparison is furnished if one examines the earliest part of the record in comparison with the latest. Professor Mead reckons that the period of heaviest cuttings took place for twenty years or so beginning with 1880. If one examines the records prior to 1880 he finds, in the seven years for which the data are recorded, just two days above the 10-ft. stage and none below the 2-ft. stage. Taking now the last seven years of the record, one finds twenty-seven days above the 10-ft. stage and ninety-nine days below the 2-ft. stage. Since Professor Mead has adduced the difference in rainfall as an explanation of such differences, it should here be noted that during the last period the annual rainfall was something like 10 per cent below the first period, in spite of which there were twenty-seven days of flood as against two.

In this connection it is worthy of note that the high-water year of 1888 was a year of slightly subnormal rainfall, while the year of heaviest rainfall during the first period, exceeding the record of 1888 by about 18 per cent, produced no days of extreme high water at all. We thus have the curious phenomenon at the end of the period of deforestation recorded of repeated floods on decidedly subnormal rainfall. Further examination does not bear out the comfortable view that difference in rainfall is chargeable with the whole difference in flow. The second period of seven years of the record, that immediately after the date stated by Professor Mead as the beginning of the heaviest cutting, happened to be a period of exceptionally high rainfall, 14 per cent greater than in the previous seven

years; yet the first period showed no days below the 2-ft. stage and but thirty-nine days below the 3-ft. stage, while the second period, of heavy rainfall, gave four days below 2 ft. and incidentally one below 1½ ft. and fifty-four days below 3 ft. It strikes us, therefore, that the appeal to rainfall is, to say the least, inconclusive. That subnormal rainfall, other things being equal, tends to low water and abnormal rainfall to high water admits of no dispute, but in this case other things which have a bearing upon the results apparently were not equal.

We refrain, in the absence of longer records than those before us, from laying much weight on the fact which Professor Mead has brought out so forcefully, that the latter part of the period of deforestation has been pretty consistently marked by lower rainfall than the earlier period. The evidence to connect actual decrease of local rainfall with local deforestation is as yet slender; but cases like that before us, in which there is a marked difference in the averages taken over fifteen or more years, certainly call for further examination. The difference in temperature between an area above, say, 1000 square miles of dense forests with lofty trees and the same area reduced to blackened slashings can hardly be regarded as negligible, and such temperature differences should, and probably do, produce local differences in precipitation. This phase of the matter, however, cannot be settled without even a more thorough and protracted examination of local conditions than Professor Mead has given us in his admirable *Bulletin*. To sum up the whole situation, it appears to us after a pretty careful examination of the data presented concerning the Wisconsin River that Professor Mead, in an entirely praiseworthy effort to take a cautious and conservative view of the facts, has considerably undervalued some of his own important data.

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## ELECTRIC TRANSIENTS.

An article by Dr. Steinmetz has recently been published in the *Journal* of the Franklin Institute on the subject of transient phenomena, especially in electric circuits. As the article contains very few and simple equations, it will be appreciated by many readers. It is a self-demonstrating but far-reaching fact that energy cannot be made to flow along an assigned possible path until it has occupied a region greater than that whence the energy immediately proceeds. If we are to obtain heat-energy from a hot-water tank there must evidently be some storage or surplusage of energy in the tank before we can draw it off. Again, if we want to obtain mechanical energy from a fall of water in a reservoir, or from the movement of a piston in a pressure-cylinder, there must be a similar storage or surplusage of energy in the reservoir or tank before it can be drawn off. By suitable design the excess of stored energy over and above the delivered energy may sometimes be reduced to narrow limits, but, in general, the storage of energy is an unavoidable concomitant of the transmission of energy. When a sudden change occurs in the transmission system changes may be looked for not only in the delivery stream, or transmission, but also in the storage. The phenomena accompanying the change in the storage may happen to be more important from some viewpoints than those accompanying the change in the transmission.

The article points out that in certain energy systems the change in energy storage occurs in one form only, while in other systems it occurs in more than one form. For instance, if a locomotive is in steady operation hauling a number of cars at a steady rate on a level track, then there will be a storage of mechanical energy in the momentum of the moving system. The only appreciable forces on the drawbars of the cars are those due to the frictions of the wheels, rails and air. If now the engine suddenly accelerates, there will be storage of energy in both engine and cars, whereby the drawbar-pulls become for the moment vastly increased. The transient phenomenon of energy-storage into the train overshadows the steady delivery of energy out of the train, but the storage is in this case of only one type, that is, momentum storage or inertia storage.

As illustrating a different phase of the subject, consider the case of a large mass, like a bass drum, fastened to the end of a long vertical spiral spring and the system placed in motion by being suspended from an elevator car. It is clear that during steady ascent the spring will be extended only by the weight of the drum and by the steady windage-pressure on it of the displaced air. Energy will stream out of the system slowly in windage friction. But energy will be stored in the system in two different ways—first, in the momentum of the drum, and, second, in the elastic extension of the spring. If the rising car suddenly accelerates, there will be a change of energy storage of each kind, and this double change of storage is likely to be accompanied by oscillations of the spring-drum system. The noteworthy feature is that when energy storage in a system is of the single type change in storage occurs steadily, but when it is of the multiple type the change is apt to occur with oscillations.

In the case of a high-tension transmission system before energy can be transmitted from the generator to the motor a certain amount must be stored in the dielectric medium environing the line. The storage occurs in two different ways, namely, electrostatically in electric flux after the manner of a Leyden jar, and magnetically in magnetic flux after the manner of a reactance coil. When the stream of energy flowing over the line is suddenly disturbed, especially in so violent a manner as occurs in a short-circuit, the energy storage of each kind suffers accompanying disturbance, and the process is effected with surges or oscillations. The article discusses these oscillations, and points out that when an oscillation-wave runs from a conductor of lower to a conductor of higher surge impedance it sets up reflections at the junction, so that, although there is no discontinuity of potential at the junction, there is a discontinuity of current and the ongoing current develops a higher voltage as it travels along the second conductor than it was able to develop along the first. Thus a surge running off a line-wire into a transformer may build up a very high voltage at a certain distance beyond the entrance, whence may come breakdown, grief and expense.

### Turin International Electrical Congress.

The sessions of the Turin International Electrical Congress will be opened on Thursday, Sept. 7, by an address of welcome from the Italian Minister of Posts and Telegraphs, which will be followed by an address by Prof. Elihu Thomson, president of the International Electrotechnical Commission. It is expected that there will be between sixty and seventy delegates present at the meeting of the International Electrotechnical Commission. There are about twenty countries represented in the commission, Holland, Switzerland, Chili and Uruguay being the latest adherents. It is expected that very shortly Peru, Greece, Portugal and Roumania will be added.

### Wire Pool Cases.

On Aug. 4 Mr. Edwin E. Jackson, supervisor of the various wire pools against which federal indictments were found, entered the plea of *nolo contendere* and was fined $45,000 by Judge Archbold, or $5,000 on each of nine indictments. United States District Attorney Wise asked for a prison sentence and vehemently denounced the methods and purposes of the accused, among other statements asserting that the records show that his profits from the wire pools amounted to $211,000 in 1908 and $197,000 in 1909, there being no record available for other years. In reply Judge Archbold said it was not possible at the time to get documentary proof of the assertions of the prosecutor, but that it appeared sufficiently demonstrated that but for Mr. Jackson the illegal agreements could not have been carried out. Inasmuch, however, as others under indictment had been fined, he would eliminate a prison sentence and impose a fine of $5,000 for each indictment, making a total of $45,000. The total of fines thus far imposed in the cases of the thirteen pools is $136,700, with ten members yet to appear before the court.

Upon motion of District Attorney Wise the indictment against Mr. Erskine Hewitt was quashed, the prosecutor informing the court that he was satisfied the indictment was in error. All others, except Mr. Jackson, were fined as in previous cases—$1,000 for the first indictment and $100 in addition for each other indictment. Counsel for several defendants who pleaded *nolo contendere* asked to have the amounts of their clients' fine lessened because they did not wilfully violate the Sherman anti-trust act and because the fine of $1,000 would mean more to them than to others. Judge Archbold said he realized this and was also aware of the great humiliation that was brought on a man when charged with a criminal act that he did not intend to commit, but at the same time he did not see how he could make an exception. In another instance the judge remarked that a good many who have unintentionally violated the law and who have pleaded *nolo contendere* may have received sentences harsher than was fair, but that it was difficult to discriminate.

### Organization of Chicago Elevated Railways Merger.

Mr. Britton I. Budd has been appointed president and Mr. E. C. Noe general superintendent of the new Chicago Elevated Railways Company, the merger of the four elevated lines and the Union loop operating in Chicago. Mr. Samuel Insull, chairman of the executive committee, is said to be the dominating figure in the operation of the properties, since it is understood that the Commonwealth Edison Company has virtually guaranteed the securities of the new merger company.

The new Elevated Railways company operates an aggregate of 173 miles of track on elevated structures within the city limits, and represents a capitalization of nearly $100,000,000, this sum being exclusive of franchise values.

Under the new plan of consolidated operation Stone & Webster, consulting engineers, have declared in a report that the Chicago elevated roads can be operated at a saving of $700,000 a year through the rearrangement of routes, etc., while the saving in the cost of energy will approximate $350,000 a year.

The board of directors under whose supervision the Chicago Elevated Railways will be operated comprises Messrs. Henry A. Blair, chairman; Samuel Insull and Ira M. Cobe. Mr. Budd, the president of the new company, has been president of the Metropolitan West Side Elevated Company for several years, and Mr. Noe, the new chief operating official, has been general superintendent for the Northwestern Elevated Railroad Company.

### Over One Million United States Patents.

The serial number of United States patents passed the 1,000,000 mark in the budget issued on Tuesday, Aug. 8. The present serial numbers, however, date only from July 28, 1836, prior to which 9957 patents had been issued. Consequently the actual million mark was reached several months ago, namely, in the budget of patents granted under date of April 18, 1911. Patent No. 1,000,000 was granted to Mr. Francis H. Holton, of Akron, Ohio, on an automobile tire, while the real millionth patent was granted to Mr. C. T. Hanson, of Lancaster, England, on a machine for making tubes from fibrous materials. According to a newspaper dispatch, Mr. Holton wrote to President Taft asking that the number 1,000,000 be assigned to his patent and the Commissioner of Patents was asked to comply with the request.

The first patent was issued in 1790, but it was not until 1854 that the annual issues definitely passed beyond 1000, the 5000 mark being reached ten years later, in 1864. In 1866 the issues jumped from 6616 to 9450, and the following year to 13,015, after which the annual output remained nearly stationary until 1880, the number of patents issued during that year being 13,947. There were considerable increases in the three following years, the number of issues for 1881-83 being respectively 16,584, 19,267 and 22,383. From 1883 to 1898 there was another stationary period, followed by a considerable jump in 1899—from 22,267 to 25,527—after which there was an irregular growth to 31,965 in 1906, followed by another jump in 1907. The issues for the past four years are as follows: 1907, 36,620; 1908, 33,682; 1909, 37,422; 1910, 35,930.

The receipts of the Patent Office per patent issued have varied little during the past half-century, the figures being as follows for the years given: 1860, $53; 1870, $50; 1880, $54; 1890, $51; 1900, $51; 1910, $56. Practically all of the present Patent Office surplus of about $7,000,000 represents clear profit derived from inventors during this half-century period, the average profit being thus nearly $7 per patent issued. The proportion of applications to patents issued has been, for decades of the fifty-year period to date, as follows, in percentages: 66, 61, 66, 57, 57.

### Electrodes for Electric Furnaces.

Two patents were issued to Mr. Carl Hering on Aug. 1 relating to electric furnaces. Of these one covers electric furnace electrodes so designed as to afford the greatest economy in material and least loss in electrical energy. The invention is based on deductions from the laws of electrode losses discovered by the inventor some years ago and described by him at that time in various papers and articles. Briefly, the fundamental principle is as follows: An electrode should be a good electrical conductor to reduce loss of energy due to electrical resistance; on the other hand, good electrical conductors are as a rule also good

heat conductors, thus tending to conduct heat freely away from the inside of the furnace where the heat is wanted. Increasing the cross-section reduces the former loss but increases the latter, while increasing the length does the reverse; the problem therefore is to find the conditions under which the total combined losses are least. This the inventor found is the case when the length and section are made such that the current heats the electrode to such an extent as to raise the inner or hot end to the furnace temperature. Under these conditions no heat will be abstracted by the electrodes from the charge in the furnace, and the entire loss of energy will thus be only the heat generated in the electrode; this, moreover, is the condition under which the total loss of energy will be the least possible, for under any other conditions the total combined losses will be greater and the electrodes will either chill the furnace product or will develop excessive heat where they pass through the walls.

These same laws also lead to economy of the materials of the electrodes, thus reducing their cost. Determinations of physical constants in the application of these laws showed the surprising fact that copper is the best material for electrodes, iron is nearly as good, and that carbon, which was the most generally used electrode material, is the worst, graphite being decidedly better than carbon. In general, the results showed that metal electrodes are cheaper and more economical in energy and should therefore be preferred whenever it is possible to use them.

The other patent of the same date on electric furnaces is for furnaces whose electrodes are designed and proportioned in this way; that is, for combinations of such electrodes with furnaces, more especially with furnaces in which the electrodes are not consumed, as in the one recently devised by the same inventor. When such electrodes are virtually prolongations of the resistors and are of the same material they automatically adjust their length so that the proportions will remain practically correct for different temperatures and currents.

## Telephone Rates at Los Angeles.

For the third consecutive year, in two of which a Board of Public Utilities has existed, an attempt to readjust telephone rates at Los Angeles, Cal., has failed. The origin of the present situation dates back a year, when, to assist in fixing a rule equitable to both the company and the consumer, the Board of Public Utilities engaged Mr. W. F. Sloan, a telephone expert of the Wisconsin State Railway Commission, to make an appraisal of the local plants. Based on Mr. Sloan's report of May 26, 1910, the board revised the schedule of rates, reducing or raising the rates for the various classes of service as the information presented seemed to warrant. The Sunset (Pacific Telephone & Telegraph Company, Bell system) and Home (Independent, automatic) telephones were given the same rates.

The City Council, closely following, passed an ordinance embodying new rates, disregarding the suggestions of the board and materially reducing, in almost every item, the charges recommended. The Home Company accepted the new schedule, but the Sunset Company immediately brought suit in July in the United States Circuit Court and was granted a temporary injunction against the enforcement of the proposed rates, thus maintaining its monthly charge for residence telephone at $3, as against the $2 rate of the City Council, the difference being placed in escrow. In its hearing the Sunset Company agreed to accept the appraisement of Mr. Sloan, $4,492,128, although lower than its own, thus sustaining the Board of Public Utilities.

In an effort to dispute the figures of Mr. Sloan and establish a basis for its rates in court, the City Council engaged Mr. Kempster B. Miller, of Chicago, to make another appraisement of this property. The inventory, made entirely independent of the former one, resulted in a valuation of $4,512,092, or about $20,000 more than that of his predecessor. With two distinct appraisements almost identical it seems certain that the city will drop its suit, or that a permanent injunction will be granted the Sunset Company, allowing it to receive about $50,000 of impounded funds.

The Board of Public Utilities began its investigations of rates for the present year at the time that Mr. Miller completed his appraisal for the City Council. Because of his thorough knowledge of the telephone business and his familiarity with the local situation he was engaged by the board to compile data upon which it could base its new rates.

His report, tendered in June, concedes a valuation of the plant of the Sunset Company within the city limits of $5,301,980 in January, 1911, including Hollywood, which was not considered in his appraisal for the City Council, and excluding San Pedro, both recently annexed portions of the city. The earnings of the company for 1910 are placed at $1,111,112 and expenses at $961,998, giving an estimated profit under its $3 rate of $149,114.

Time was not sufficient for Mr. Miller to make an inventory of the Home Company, and the statement of that

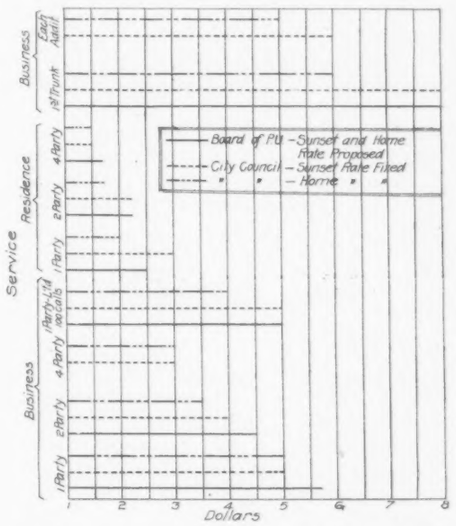



**Diagram Showing Proposed and Fixed Telephone Rates at Los Angeles.**

company filed at the commencement of the year was employed. This states an investment of $5,764,545.59, neglecting franchise. Earnings are given at $1,022,808.01 and operating expenses at $814,935.72, including a sum of $290,395.72 for depreciation; other expenses are placed at $285,555.97.

Upon these figures and recommendations of Mr. Miller the board established rates for the ensuing year practically identical with those suggested the year previous. These are shown for the important classes of service in the accompanying diagram. Both companies were placed upon an equal footing as to charges, the revenue of the Sunset being increased about $7,400 and that of the Home $21,000 monthly, upon which the rates allowed return of 5.5 per cent and 7.07 per cent respectively. In January, 1911, the total number of telephones within the city limits was 41,056 for the Sunset and 39,423 for the Home.

Many protests from citizens and business interests were filed against the proposed rates with the City Council. Accordingly, that body investigated the issue, appointing a committee of three from its membership to fix the rates from the data available.

The Board of Public Utilities, which has since resigned, defended its position by citing references to sixty different

cities, in ten of which the number of telephones approximates the number in local use. The closest parallel is stated to be Cleveland, with a business rate of $7 and residence charge of $4, comparing with $5.75 and $2.50 recommended by the board for Los Angeles.

On July 25 the City Council authorized, from the findings of its committee, an ordinance drafted establishing rates identical with the present ones, notwithstanding its legal defeat by the Sunset Company. The suggestions of the board and its engineers were disregarded. The ordinance was passed by the body on July 28 and signed by the Mayor, becoming effective Aug. 27. The rates fixed by the Council are shown in the accompanying diagram.

These charges, which again become effective, were established by the companies themselves, the Sunset rate by ordinance No. 17,972 (new series) adopted March 19, 1909, the Home rate by ordinance No. 20,331 (new series) of May 31, 1910.

This leaves the situation the same as before the Board of Public Utilities was created, the expenses which have resulted through investigations and appraisements and the employment of the best engineering talent costing the city many thousands of dollars to no ultimate purpose. It is expected that the Home Company will follow the line of the Sunset in an appeal to the courts asking for an injunction against the fixed rates.

Agitation is in force for an interchange of service between the systems, eliminating the expense of two telephones. Owing to this interesting phase of the problem, and being upon the ground, Mr. Miller offered to investigate this subject for the City Council at a reasonable consideration of $1,000, but the proposal was refused. The Mayor has instructed the new Board of Public Utilities to give its attention to intercommunication possibilities.

## Toledo Rate Situation.

The fight being waged by the city of Toledo, Ohio, against the lighting department of the Toledo Railways & Light Company is of about the same nature as that against the street-railway lines. In both cases the city has laid down rates and conditions and is now engaged in an endeavor to force the company to accede to them. Mayor Brand Whitlock, a friend of the late Mayor Tom L. Johnson, of Cleveland, is leading the city's forces, while he has an ambitious lieutenant in City Solicitor Cornell Schreiber. The conditions, so far as the administration is concerned, are similar to those in Cleveland a few years ago, with the exception that force is being applied in a somewhat different manner to coerce the company.

Judge Manton, of the Common Pleas Court, was asked to grant an order restraining the company from demanding or receiving pay for energy for lighting purposes in excess of the rate of 8 cents per kw-hour, with a discount of 1 cent if payment is made within ten days, as fixed by an ordinance recently passed by the Council, but the court took time to think the matter over and then announced that the action would not be taken unless the city furnished a bond sufficient to cover the difference in case the order should be dissolved on final hearing of the case.

Through Attorney Barton Smith the company objected to the restraining order at the hearing last Thursday on the ground that the company could realize little from a bond given by the city, because it would be required to show that it had used every reasonable effort to collect from the consumers before it could look to the bond. The court, however, said the company would not be put to this test, but if the decision should be in its favor there would be no necessity of showing that it had tried to collect more than the ordinance rate before it could demand relief from the bond. Mr. Smith insisted that the Council did not have authority to fix the rate, but the court held that the State laws give it that power. Regarding this point the court said:

"You are doing business under the laws of the State of Ohio. The State says that if you want to do business here you must submit to certain regulations. The State has given the Council the right to fix your rates. If the Council establishes a rate it is your duty to comply with the regulation, and then if there is anything confiscatory about it you have your remedy in coming into court. Council after public hearings established a rate and we must assume that the rate is reasonable, and it is incumbent upon you, upon final hearing, to show wherein it is unreasonable or confiscatory. Meanwhile you must comply with the ordinance."

Attorney Smith said that if the order is enforced it will be necessary for the company to cut off hundreds of consumers who would get the benefit of the 50-cent monthly minimum provision. The court stated that this question is not up and that under any order the court issues now all the customers could be shut off without violating the order. City Solicitor Schreiber stated that if any are cut off the matter will be taken into court at once.

Mr. Smith declared that the law which allows city councils to fix the rates is unconstitutional, but said the State Supreme Court had decided one way and the United States Supreme Court another, and that it will be necessary to go to the latter to have the State court set right.

Since the above was written Judge Manton granted an order restraining the Toledo Railways & Light Company from demanding or receiving from consumers more than 8 cents per kw-hour and a discount of 1 cent per kw-hour, with a minimum charge of 50 cents per month, for lighting purposes. The court in its decision said that the facts pleaded in defense do not, under the laws of the State, show any invasion of the defendant's constitutional rights, and the spoliation complained of is not sustained by the facts admitted at the hearing.

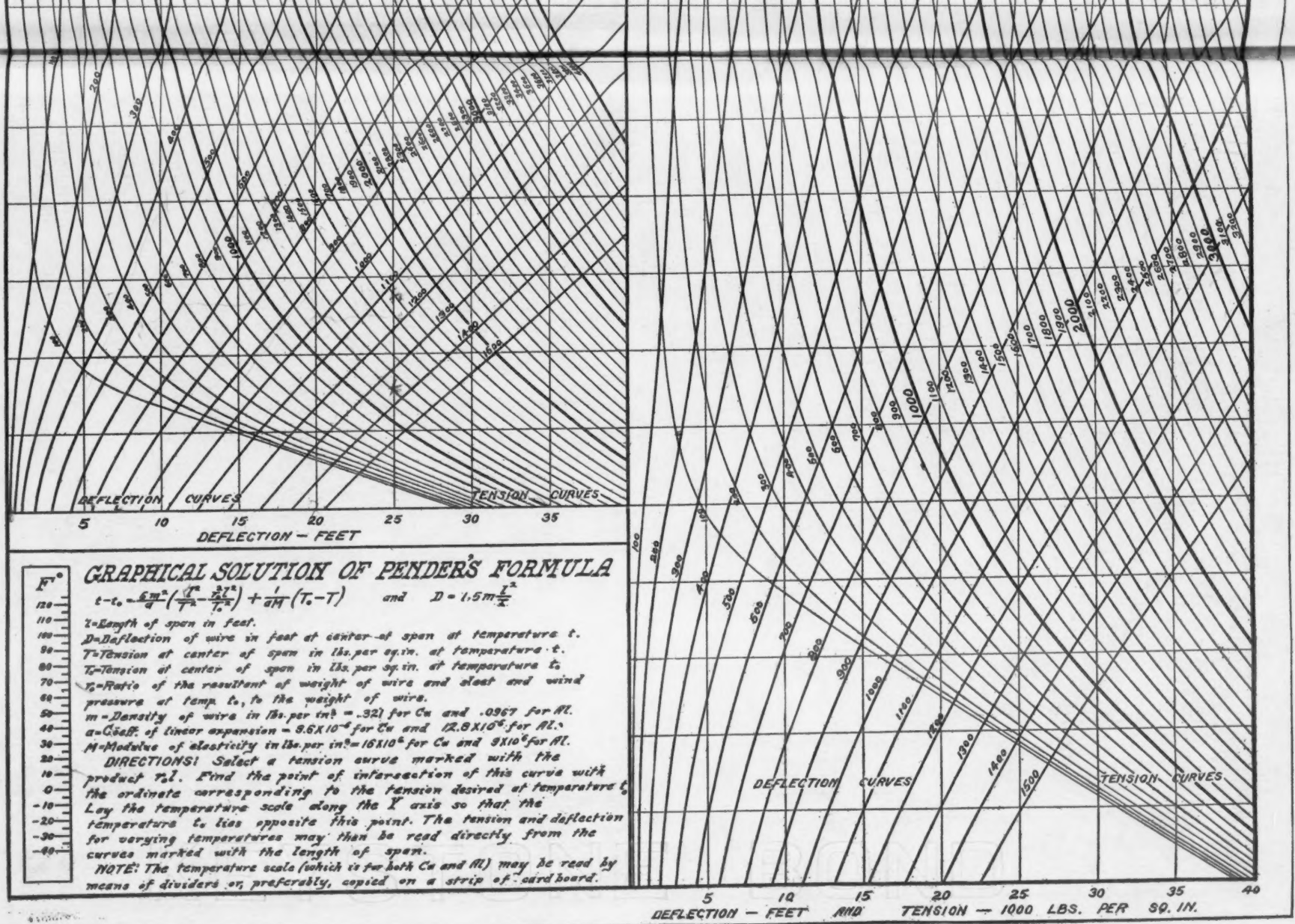
"It is admitted that only 8 per cent of the current produced and sold by the defendant is affected by this ordinance and that 92 per cent is sold for less than the price fixed in the ordinance. It would appear from these figures, which are given by defendant's counsel, that defendant would have no difficulty in adjusting the situation to meet the ordinance rate and prevent loss to itself.

"Taking the difference between the original rate and the rate provided for in the ordinance in question as 1 cent, the amount which the company will have to take care of and adjust would be $490 per month, or $5,880 per annum. This does not look to me like an act of spoliation, considering that a large amount of the output of the defendant company is sold as low as 3½ cents per kw-hour.

"The power of the Council to afford protection to the small consumers is undoubted, and the hardship imposed on this corporation to readjust its contracts to avoid loss does not appear to me to be a very heavy one."

## Central-Station Taxation in Ohio.

The Ohio State Tax Commission is now giving attention to central-station plants. The most interesting case considered so far is that of the Cleveland Electric Illuminating Company, the tentative value of whose property had been fixed at $12,000,000. The valuation a year ago was put at $3,790,895, the increase being approximately 330 per cent. Vice-president Samuel Scovil was notified to be present at a hearing on this valuation late last week, but instead the company sent a brief prepared by Attorney T. H. Hogsett in which it was stated that the valuation named by the commission is entirely too high. The brief mentions that Cleveland has more electric light and power companies and private plants than any other city in the United States in proportion to its population. Most of the large buildings,


DEFLECTION CURVES
TENSION CURVES
5 10 15 20 25 30 35
DEFLECTION — FEET
DEFLECTION CURVES
TENSION CURVES
5 10 15 20 25 30 35 40
DEFLECTION — FEET AND TENSION — 1000 LBS. PER SQ. IN.

# GRAPHICAL SOLUTION OF PENDER'S FORMULA

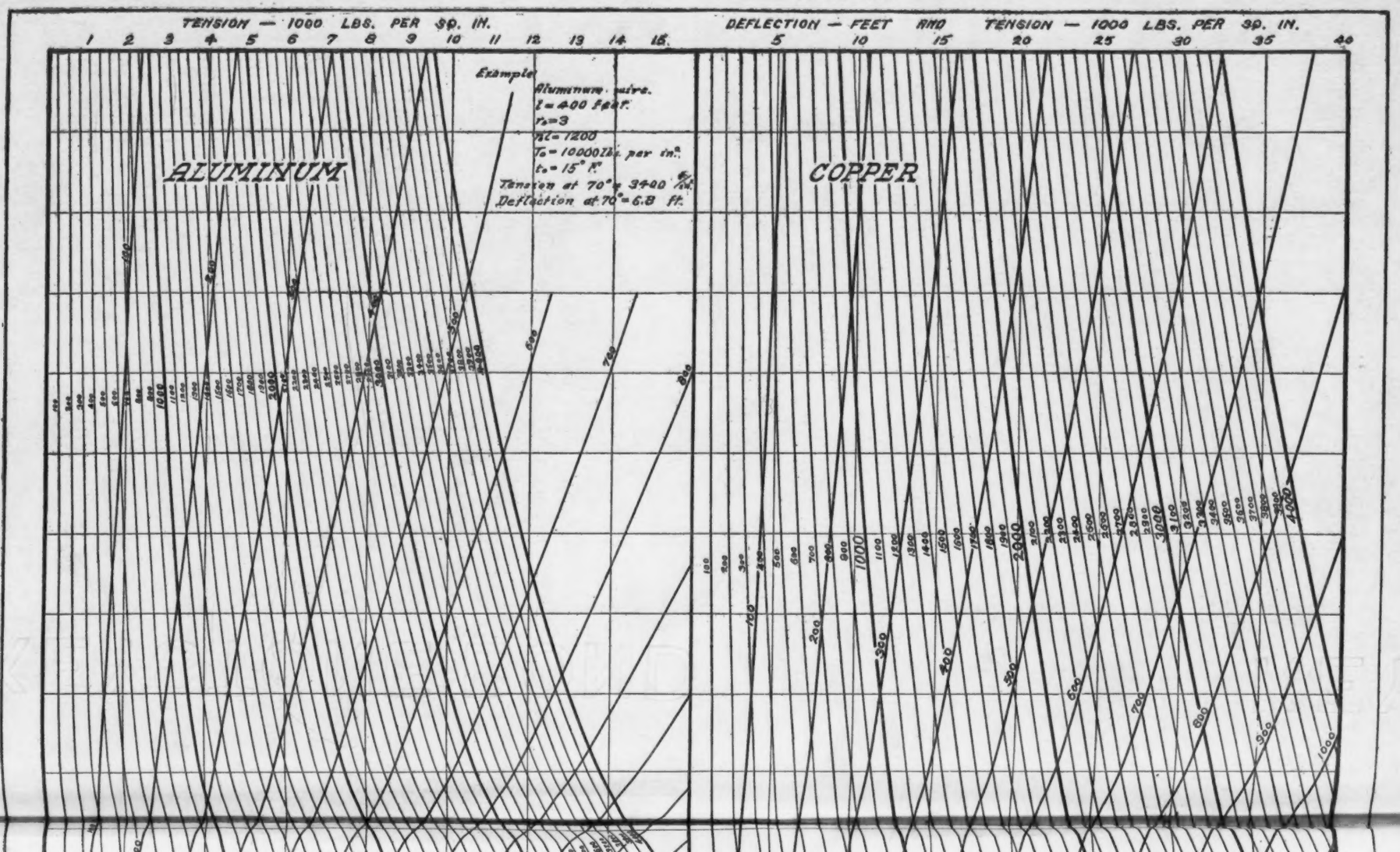
$$t - t_o = \frac{6m^2}{d}\left(\frac{T}{T_o} - \frac{3T_o l^2}{T_o}\right) + \frac{1}{aM}(T_o - T) \quad \text{and} \quad D = 1.5m\frac{l^2}{T}$$

$l$ = Length of span in feet.
$D$ = Deflection of wire in feet at center of span at temperature $t$.
$T$ = Tension at center of span in lbs. per sq. in. at temperature $t$.
$T_o$ = Tension at center of span in lbs. per sq. in. at temperature $t_o$.
$r_o$ = Ratio of the resultant of weight of wire and sleet and wind pressure at temp. $t_o$, to the weight of wire.
$m$ = Density of wire in lbs. per in.$^3$ = .321 for Cu and .0967 for Al.
$a$ = Coeff. of linear expansion = $9.6 \times 10^{-6}$ for Cu and $12.8 \times 10^{-6}$ for Al.
$M$ = Modulus of elasticity in lbs. per in.$^2$ = $16 \times 10^6$ for Cu and $9 \times 10^6$ for Al.

DIRECTIONS: Select a tension curve marked with the product $r_o l$. Find the point of intersection of this curve with the ordinate corresponding to the tension desired at temperature $t_o$. Lay the temperature scale along the Y axis so that the temperature $t_o$ lies opposite this point. The tension and deflection for varying temperatures may then be read directly from the curves marked with the length of span.

NOTE: The temperature scale (which is for both Cu and Al.) may be read by means of dividers or, preferably, copied on a strip of card board.

F°
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40


TENSION — 1000 LBS. PER SQ. IN.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DEFLECTION — FEET AND TENSION — 1000 LBS. PER SQ. IN.
5 10 15 20 25 30 35 40
ALUMINUM
COPPER
Example
Aluminum wire.
l = 400 feet.
r₀ = 3
Wl = 1200
T₀ = 10000 lbs. per in².
t₀ = 15° F.
Tension at 70° = 3400 lbs. per in².
Deflection at 70° = 6.8 ft.

it is stated, have their own plants and not only supply their own tenants, but those of neighboring buildings. This materially reduces the earnings of public-utility companies.

The commission has an interesting case in the Price-Hill Electric Company, of Cincinnati, the value of whose property has been advanced from $36,000 to $125,000. The company operates a plant to haul vehicles up a steep hill and contends that it is not a public-utility corporation, but merely a corporation, and that as such it should not be taxed by the commission but by the local board of review.

The smallest increase accorded to any public-utility corporation up to this time is 100 per cent, the Dresden Electric Company being the fortunate one. Its valuation was boosted from $2,500 to $5,000. The others have varied between 300 per cent and 700 per cent, and some have gone higher. Among the companies whose values have been increased tentatively are the following:

| | Former. | New. |
|---|---|---|
| Cleveland Electric Illuminating Company | $3,790,895 | $12,000,000 |
| Price-Hill Electric Company | 36,000 | 125,000 |
| Dresden Electric Company | 2,500 | 5,000 |
| Eaton Lighting Company | 8,960 | 30,000 |
| Electric Light Company of Ottawa | 6,010 | 45,000 |
| Ferry Light Company, Fayette | ..... | 700 |
| Greenville Electric & Power Company | 16,560 | 75,000 |
| Jamestown Electric Light Company | 5,000 | 12,000 |
| Leetonia Light Company | 2,300 | 8,200 |
| Medina Electric Light & Power Company | 2,710 | 18,000 |
| F. W. Guinser Electric Light Company | 1,500 | 5,000 |
| Lancaster Electric Light Company | 12,000 | 90,000 |
| Springfield Light, Heat & Power Company | 207,000 | 790,000 |
| Standard Light & Power Company | 26,350 | 50,000 |
| Urbana Light Company | 28,825 | 80,000 |
| Union Light & Power Company | ..... | 10,000 |
| Wooster Electric Company | 8,777 | 87,000 |
| Wilmington Water & Light Company | 26,700 | 100,000 |
| West Liberty Electric Light Company | 3,000 | 10,000 |
| New Lisbon Gas Company | 6,620 | 12,000 |
| Defiance Gas & Electric Company | 30,800 | 130,000 |

## The Establishment of Electric Rates.

Before the City Club of Los Angeles, Cal., at its meeting on July 29, Dr. George L. Hoxie, of New York, a member of the board of three consulting experts recently engaged to assist the Board of Public Utilities of that city in establishing electric rates for the ensuing year, made an interesting address on rate fixing, incidentally dealing with the present situation in Los Angeles.

Dr. Hoxie said that rate fixing consists in making such rates as shall not confiscate the property of the corporations and also in giving the people rates which shall not be discriminatory as between consumers and which shall not yield the corporations too much money. When real money is honestly expended to produce a valuable public utility and the best engineering skill has been employed the people have no right to confiscate that property. Nor is the actual value of the property entirely on the physical showing. Necessarily there are some mistakes made in constructing a plant, some machinery purchased that is soon superseded by better machinery and some engineering inaccuracies which time alone can bring to light and remedy. This, Dr. Hoxie said, has been particularly true in southern California, where engineers and capitalists have been the pioneers in certain lines of electrical construction and where the men who put in money took risks no Eastern capitalist would have taken. Progress since then has been very rapid. The daring of these men meant a great deal to electrical engineering and to the companies, but they have been costly. These costs cannot be entirely covered by the physical valuation given a plant nor by the natural depreciation charge allowed.

In speaking of the present conditions at Los Angeles, Dr. Hoxie said that they were unfortunate, and the action of the City Council in fixing light and power schedules, eliminating the recommendations of the Board of Public Utilities, was unwise. Instead of accomplishing beneficial reductions the body succeeded in confusing the rate-fixing regulations. Referring to the work of the board, he said that in the inventory of the properties values were figured on what it would cost to reproduce the properties new and then applying what is known as the "straight-line depreciation" basis. This system allows depreciation on the basis of the number of years it would take for a plant to become entirely worn out. If a plant would last fifteen years and is one year old a depreciation of one-fifteenth for that year is allowed.

There are, he said, three kinds of consumers—for residence lighting, for commercial lighting and for commercial power. It is as unfair to compare the rates for the first class with that of the third as it would be to go to a jeweler's and compare his diamonds with a lump of anthracite coal and expect each to be sold at the same price because they are both carbon. The "connection charge" basis is, he said, the only correct and scientific one. Within ten years all the cities of the country will be adopting it and Los Angeles, instead of being in the forefront in the matter, will be bringing up the tail of the procession.

Dr. Hoxie made reference to the city's hydroelectric system which is to develop from the aqueduct and gave warning that the forces which have upset rate making may lead to the municipal system being a "football for politicians."

## Ohio Commission News.

Attorney-General Timothy S. Hogan, of Ohio, has rendered an opinion to the Public Service Commission to the effect that no assessments can be made upon the corporations coming under its jurisdiction for the purpose of paying expenses until June 30, 1912, and no collections can be made until after that time. Members of the Legislature who had the public utilities bill in hand did not look into this matter closely and allowed some of its provisions to conflict with other laws, requiring reports from railroads and other corporations for the year ending June 30 to be made in September. The new law provides for an assessment in August to supply the needs of the commission.

The Legislature appropriated $75,000 as an advance to the commission until the fees should begin to come in, but it is probable that the commission will have to be satisfied with this amount of money for the coming year, unless it can use the $45,000 which has been paid to the State Railroad Commission in the past.

## Wisconsin Commission News.

The commission has approved the simplified schedule of rates submitted by the recently organized Ozankee-Washington Telephone Company. The new company is a combination of three independent companies with widely diversified rate schedules. The rates ordered effective are as follows: Party line, $12 per year for residence and $15 per year for business telephones; single line, $18 per year.

In the matter of the Pewaukee-Sussex Telephone Company's petition for authority to increase rates the commission has authorized a portion of the increase asked for. The petition called for an increase in rates for business telephones from $15 net yer year, the present rate for all telephones, to $25 net yer year. A rate for business telephones of $18 net per year was granted by the commission. In reviewing the case the commission called attention to the fact that the rate for business telephones should properly

be higher than for residence telephones. The investigation showed that the company at present is earning more than 12 per cent on its investment, and normally the difference in the two rates should be obtained by decreasing the residence rate. However, a comparison of the rates and operating expenses of the petitioner with similar items in other exchanges of the same size and under the same conditions revealed the fact that the rates of $15 for residence and $18 for business telephones were equal to or below the average for the other exchanges. Furthermore, the operating expenses were shown to be considerably below the average of the other exchanges in the State. Consequently the commission felt justified in increasing the business rate notwithstanding the already high rate of return enjoyed by the petitioner, for the reason, as above stated, that this condition of affairs is not due to excessive rates, but to a very low operating expense.

The Wisconsin Telephone Company was unsuccessful in its appeal to the commission to be relieved from the necessity of removing or placing underground its wires and cables along certain paved streets in the city of La Crosse as ordered by the Common Council. The chief arguments advanced by the plaintiff concerned the impossibility of using underground cables for toll service and the expense incident to the removal of the wires with the possible necessity of acquiring a private right-of-way. In reviewing the case the commission recognized the city's right to require the removal of all poles along its thoroughfares when public policy and expediency demanded such removal. The reasons given by the city were deemed sufficient and satisfactory. Furthermore, an investigation showed that the effects resulting from a compliance with the ordinance would not be as serious as the commission was led to believe.

The new law passed by the last Legislature broadening the powers of the commission by giving it authority over all the water-powers of the State is meeting with considerable opposition on the part of the water-power owners of the State. Meetings are being held to devise ways and means of preventing the enforcement of the law.

## Massachusetts Commission News.

The Worcester Suburban Electric Company has petitioned for authority to issue new capital stock to the amount of $125,000 to pay floating indebtedness and to make additions and improvements in its plant.

The Gloucester Electric Company has petitioned the commission for permission to issue $75,000 additional capital stock, to consist of 750 shares of $100 each, for the purpose of placing its wires underground in the principal streets of the city and to pay for the construction of light service in the town of Essex, which includes about 12 miles of public street lighting and 6 miles of streets on the commercial-lighting service. A hearing was held Aug. 1 on this petition.

The company proposes to lay 5990 ft. of underground conduit in all, which will require the laying of about 65,000 ft. of single duct and the building of about sixty-five manholes and 250 service connections.

Work was begun in May of this year, and up to June 1 32,151 ft. of single duct was laid, covering 2731 linear ft. of street, with twenty-four manholes, and costing about $9,600. The estimated cost of the whole work is as follows:

| | |
|---|---|
| For conduits laid | $18,806 |
| For cables | 16,400 |
| For services | 2,750 |
| For pulling in cables | 3,990 |
| For manholes | 4,400 |
| For subway transformers | 1,500 |
| For automatic regulators | 1,500 |
| | $49,340 |

Treasurer Charles F. Pritchard presented the case at the hearing. It is proposed to rearrange the present coal storage in the station, installing an industrial-railway system with three tracks. The bin will have a capacity of 30 tons to 40 tons of coal—two to three days' supply. New machinery will be installed at an estimated cost as follows:

| | |
|---|---|
| Two 254-hp boilers, set | $7,500.00 |
| Stokers for same | 2,500.00 |
| Conveyor, bin, weighing machine, erected | 4,000.00 |
| Piping | 3,000.00 |
| Building addition, 20 ft. x 42 ft. 9 in. | 2,580.00 |
| Raising roof of present boiler-room | 1,000.00 |
| Retaining wall and modification of present coal storage | 2,197.00 |
| Industrial railway with car | 750.00 |
| Addition to coal trestle | 650.00 |
| | $24,177.00 |
| 10 per cent for engineering, incidentals, etc. | 2,417.70 |
| Total | $26,594.70 |

The present boiler-room is 5 ft. 6 in. x 42 ft. 9 in. and 24 ft. 5 in. to 23 ft. 5 in. in height. In this are four 125-hp horizontal-tube boilers, three on the westerly side of the chimney and one on the easterly side. It is proposed to build an addition 25 ft. in length and to raise the roof from 4 ft. to 6 ft. to allow plenty of head room over the new boilers. It is proposed to remove the boiler on the easterly side of the chimney and to install two Babcock & Wilcox vertical boilers of 254 hp each. They will be twelve tubes high and twelve wide, with wrought-iron headers and designed for 200 lb. working pressure. It is proposed to fit these boilers with Murphy stokers with hoppers which will be filled by means of a small weighing machine operated by hand and moving on overhead rails. This machine will be fed from an overhead bunker placed in front of the chimney and underneath the present ventilator, which is 7 ft. higher than the roof.

The construction in the town of Essex cost for the work done to June 30, 1911, as follows:

| | | |
|---|---|---|
| 682 poles and paint | | $2,888.17 |
| Total labor | | 3,954.66 |
| 25 miles wire, street lights | $2,125.00 | |
| 17½ miles wire, consumers' lights | 2,195.52 | |
| | | 4,320.52 |
| Cross-arms, pins and insulators | | 682.00 |
| Street lamp fixtures | | 378.55 |
| Lamps | | 101.70 |
| Surveying, plans, etc. | | 283.50 |
| Incidental, teaming, etc. | | 468.80 |
| Meters | | 781.31 |
| Transformers | | 809.31 |
| Total | | $14,668.52 |

There are installed 113 street lights and about seventy-five commercial consumers are connected, with approximately 1000 lamps.

The present capital stock of the company is $175,000. It paid a dividend in the last fiscal year of 7 per cent.

The construction work of the underground conduits is in charge of Mr. I. I. Edgerly, of Tuttle & Edgerly, Swampscott, Mass., on a 10 per cent allowance above cost. The company buys its own materials. The work is suspended until Sept. 1 owing to the large number of summer residents in and about the city. The conduit to be laid in the main street will be placed under the sidewalk for a large part of the way, being placed about 1 ft. under the paving of the sidewalks.

## New York Commission News.

The New York Edison Company has filed with the Public Service Commission a petition asking for a rehearing in the case of the Long Acre Electric Light & Power Company, in which a majority of the commission recently decided that the Long Acre company should be allowed to issue $2,000,000 in stock and $4,000,000 in bonds under certain conditions. The petition will be presented to the commission at its next meeting.

In the petition several reasons are advanced as grounds for the request for a rehearing. It is stated that a majority opinion of the commission finds "that no evidence was offered subsequent to Dec. 1, 1910, before the commis-

sion which changed the state of facts from that which existed at the time of the appeal to the Appellate Division." The Edison company asserts that a great deal of testimony which materially changed the state of facts was offered subsequent to Dec. 1, 1910. The Edison company contends that the majority opinion omitted to consider such facts, and that unless they are considered and given full force and effect the Edison company will be seriously injured and that the failure to consider them is sufficient warrant for asking a rehearing.

The petition asserts that the order giving the Long Acre company the right to issue stock and bonds contains no findings of fact or conclusions of law and, therefore, the Edison company "deems it necessary and advisable that specific findings be made by the commission so that they may be reviewed in connection with the evidence by the Appellate Division of the Supreme Court." It is declared that the majority opinion is erroneous because it does not consider the facts placed before the commission and is also contrary to law and the order of the commission contrary to facts and law.

It is alleged by the petitioner that there is no public necessity for a competing company in Manhattan and the Bronx; that the Edison company recently reduced the price of electricity to consumers; that no complaints have been made to the commission that its charges have been unreasonable and unjust; that it is subject to vigorous regulation, has made a large investment in the County of New York which should be protected, and "unless the order of the commission is reconsidered its loss caused by duplication of investment will be large and it will suffer serious loss because of its investment in the Consolidated Telegraph & Electrical Subway Company, which company would be compelled to expend a large sum of money for the accommodation of the Long Acre Electric Light & Power Company without any prospect that the investment would be productive for any length of time whatever."

The New York Public Service Commission, Second District, has received applications from the Mohawk Hydroelectric Company and the Fort Plain Gas & Electric Company for consent to a contract leasing the portion of the Fort Plain company's distribution system situated in the village of Nelliston to the Mohawk Hydroelectric Company. The Fort Plain company is now receiving energy from the Fulton County Gas & Electric Company and proposes to change its source of supply to the Mohawk Hydroelectric Company. Under the new contract with the Mohawk Hydroelectric Company it is stated that the Fort Plain company will be in position to render better service and to increase its opportunities for enlarging its business and prevent future interruptions to its service such as have occurred in the past. The Mohawk Hydroelectric Company has also asked for permission to begin construction and operate a transmission system for the supplying of electricity in the towns of Ephratah and Palatine and the village of Nelliston under franchises granted by these municipalities. The Mohawk Hydroelectric Company has also asked for authority to issue its 6 per cent thirty-year gold bonds to the amount of $56,000 for construction of a substation and a transmission line from its generating station in the village of Ephratah to the villages of Nelliston and Ft. Plain.

## CURRENT NEWS AND NOTES.

ELECTRIFICATION OF BERLIN INTERURBAN RAILROAD.—Plans are being made for the electrification of the Stadt und Ringbahn in Berlin. This railroad encircles the city and carries a great part of the traffic from the suburbs.

* * *

ELECTRICITY FOR FARMERS.—Hon. Adam Beck, of the Ontario Hydroelectric Commission, has announced that the commission will make the distribution of electrical energy one of the chief features of its work. During a recent trip to Europe he found that in practically all countries electricity is extensively used on farms of from 25 acres to 1000 acres. On a government model farm in Bavaria from 25 acres to 30 acres are plowed in one day by a single electric plow.

* * *

ELECTRIC POWER FOR FIRE-DEPARTMENT SERVICE.—In an interview upon his return from a trip to Europe Hon. Adam Beck, of the Ontario Hydroelectric Commission, said that the city of Berlin fire department has adopted electric power. Four stations already have electric equipments, and several gasoline fire "engines" will be replaced by electrics. The electric costs only about half of horse service, and it is but twelve seconds from the time an alarm is sounded until the electric equipment is out of the station. Many German municipalities, he said, have electrically propelled street-watering wagons.

* * *

EDISON FETED IN LONDON.—Mr. Thomas A. Edison has received a reception in London which recalls the honors showered on him during his visit to Paris in 1889. Upon a visit to the House of Commons the Speaker gave orders that he be escorted to the distinguished visitors' gallery. Upon the close of the session the Speaker and members tendered Mr. Edison an ovation and as a souvenir of the occasion he was presented with a copy of a Parliament bill autographed by Premier Asquith, Lloyd-George and other leaders in the Commons. He expressed the opinion that it is high time that the British hereditary system be abolished and declined to visit the House of Lords.

* * *

HIGH-POWER NAVY WIRELESS STATION.—The new wireless station now being installed at the Charlestown Navy Yard, Boston, Mass., will be among the most powerful in the world, having a maximum range under favorable conditions of about 3200 miles. The new building to house the station will be erected of stone, and there will be two aerial poles, each 170 ft. high. The old equipment, mostly Stone wireless apparatus, will be supplanted by modern Telefunken sending apparatus, with a Pickard receiver. There will be a 5-kw Telefunken high-frequency, quench-gap machine, the old sending equipment being a 2-kw Stone low-tone spark machine. Chief Electrician J. E. Simpson and Operators W. J. Stedman, F. C. Johnson, J. Lucas and J. J. Harrigan will be in charge.

* * *

TEXAS HYDROELECTRIC PROJECT.—The Medina Irrigation Company, headed by Dr. F. S. Pearson, of New York, has enlarged its plans for irrigating lands in different parts of south Texas with the incidental generation of hydroelectric power. Besides a large dam that is to be erected across the Medina River a few miles west of San Antonio water rights have been filed for the Guadalupe River at points 9 miles and 12 miles above Kerrville. It is announced that two auxiliary terminals will be constructed at the two latter places for the purpose of storing water for the irrigation of 30,000 acres of land in addition to the 100,000 acres that are to be irrigated in the valley of the Medina River. The cost of the dams and canal system near Kerrville will be approximately $2,000,000. The company has also filed water rights for the Frio and Nueces Rivers in Uvalde County and two or more large dams will be erected across those streams to form water-storage reservoirs. The original estimated cost of the irrigation and hydroelectric works that were to be installed by the Medina Irrigation Company was $6,000,000. The enlarged plans, however, bring this estimate of cost up to $12,000,000.

Public Service Commission Recognizes Dividend Value of Efficient Management.—As noted in the report elsewhere of recent proceedings of the Wisconsin Rate Commission, that commission allowed an increase in telephone rates notwithstanding that the company was earning more than 12 per cent on its investment. The ground given was that the higher rate was not unreasonable and that the large return on investment was due to very low operating expenses.

* * *

Amoskeag Mills Power Plant Again Enlarged.—An additional 5000-kw generator is soon to be installed at the power plant of the Amoskeag Manufacturing Corporation, at Manchester, N. H., a description of which appeared in the issue of June 22, 1911. At the same time several new turbines and a large transformer will also be installed. It is also planned to put in a cable to connect the various divisions of the plant more closely, consisting of a triple-conductor submarine cable, to be laid in the bottom of the canal, where danger of injury will be minimized. The cable, which will be 3 in. or more in diameter and have a total length of about 1 mile, will weigh between 130 tons and 140 tons.

* * *

New York Edison's Association of Employees.—While no regular monthly meetings of the Association of Employees of the New York Edison Company are being held during the summer, the board of trustees is transacting routine business and the membership committee continues its campaign for new members. Ninety new members have been added since the last meeting in May. In view of the large growth of the mortuary funds the board of trustees has withdrawn the funds from savings banks and has made provisions for investing the money to bring larger returns, having purchased eleven $1,000 4 per cent bonds of the New York Gas & Electric Light, Heat & Power Company. The association, while less than six years old, has over $15,500 in its treasury.

* * *

Louisiana Electrical Association.—The Louisiana Electrical Association was organized July 22, and includes in its membership the leading electrical contractors of New Orleans, and the objects of the association as set forth by the constitution are "to foster trade among electrical contractors, to reform abuses and secure freedom from unlawful and unjust exactions, settle differences between its members, promote more enlarged and friendly intercourse between members and to diffuse accurate and reliable information among members as to the standing of merchants, builders and others engaged in the erection of buildings or the furnishing of electrical materials therefor." The officers of the association are as follows: Mr. Roydan Douglas, president; Mr. Thomas J. Burke, vice-president; Mr. W. H. Bower Spangenberg, secretary; Mr. Henry Widmer, treasurer, and Mr. W. H. Earl, sergeant-at-arms.

* * *

Improvements in Denver Station.—A number of improvements have recently been made in the West Side station of the Denver (Col.) Gas & Electric Light Company. Five of the old hand-fired boilers have been equipped with liquid fuel burners and water-gas tar is being utilized as fuel. At present the gas works of the company are supplying something like 35,000 gal. of this tar a month and to store it conveniently two tanks, 31 ft. long by 6.5 ft. in diameter, have been erected in the rear of the station building. From these tanks, each of which has a capacity of 10,000 gal., the tar is pumped to a 5000-gal. tank located on a tower giving a head of 30 ft. at the burners. In order to handle the energy at present received over the lines of the Central Colorado Power Company another set of oil switches has been installed to replace the old switches, which have become inadequate to control the load, and the switch platform below the main switchboard has been extended 6 ft. for this purpose. Improvements have also been made in the station wiring, especially in the boiler-room, where the lamp circuits have all been placed in rigid conduit to reduce the fire hazard.

* * *

Electrical Fraud Prosecuted.—The Post Office Department has arrested the inventor and promoter of the Sun Electric Generator Company on the charge that it has defrauded investors out of sums aggregating $250,000 by inducing them to buy stock in an invention having no commercial merit. The inventor is Mr. George H. Cove, and his so-called invention is a thermoelectric battery, which, if erected in a back yard or on the roof of a building, would, it was claimed, generate enough electricity from the sun's rays in one day to last a household from one to two weeks. An installation set up on the roof of a building in Maiden Lane, New York City, from which incandescent lamps were supplied, was found to be connected by concealed wires with the Edison service in the building. Many inquiries regarding the scheme have been received at this office, and it was apparent that the promoters operated largely through a "sucker" mailing list such as is used by other electrical "fakes" still doing business.

* * *

I. E. S. Annual Convention.—According to the arrangements that have thus far been completed there will be five technical sessions at the Chicago convention of the Illuminating Engineering Society Sept. 25, 26 and 27. These sessions will be held in the Congress Hotel on Monday morning, Tuesday morning, Tuesday afternoon, Wednesday morning and Wednesday afternoon. A reception and dance will be given on Monday evening. On Tuesday evening there will be a subscription dinner. According to the preliminary technical program twenty subjects will be covered by committee reports or original papers. Among the authors are President A. E. Kennelly and Messrs. A. J. Humphreys, Louis Bell, E. H. Bostwick, G. H. McCormick, A. J. Marshall, L. W. Young, F. L. Godinez, Bassett Jones, W. H. Gartley, G. S. Barrows, J. E. Randall, George H. Keech, A. S. McAllister, George H. Stickney, P. S. Millar, L. J. Lewinson, H. E. Ives, C. L. Smart, E. L. Elliott, George L. Dyer, F. B. Rae, C. P. Steinmetz and H. E. Clifford.

* * *

Federal Water-Power Policy.—In an address before the Michigan School of Mines on Aug. 9 Director George Otis Smith, of the United States Geological Survey, in speaking of the subject of water-power legislation said that the position of the Geological Survey is essentially that set forth in January of this year in a report addressed to the Secretaries of the Interior and of Agriculture by a joint committee representing the two departments. The legislation there outlined would provide for lease of public and reserved lands of the United States valuable for water-power development for a fixed term, not to exceed fifty years, with moderate charges for use and occupancy of the land, and revocable only upon breach of conditions or on account of the charge of excessive rates to consumers. These leases should be identical in terms, whatever the department under which they are granted, with joint and uniform regulations governing all matters relating to water-power development of land belonging to the United States. Provision should also be made for periodic and equitable readjustment of charges, transfer of leases, preferential rights to renewal and compensation for improvements at the termination of the leasehold. The law should specifically recognize water-power use as dominant and both insure to the lessee undisturbed occupancy of the land needed for such use and reserve for future utilization all the land believed to possess value for water-power development, these lands to be designated by the President, but to be open to other entry subject to this reserved right wherever separation of the water-power use and other use is possible.

## HYDROELECTRIC DEVELOPMENT IN NORTHERN ONTARIO.

### Generating Station and Substations of the Nipissing Power Company on the South River Near North Bay.

AN interesting hydroelectric station has been completed for the Nipissing Power Company on the South River near the village of Nipissing, Ontario, by Messrs. Smith, Kerry & Chace, of Toronto, who also act as operating engineers for the project. As hydroelectric stations go, the development is not large, the present installation aggregating less than 1000 kw, but provision has been made for additions which will bring the rating up to 2250 kw, and the market is promising. There is a 20-mile aluminum-transmission line in connection with the development, and not the least interesting feature is the small substations at North Bay and Callander, especially the latter. The territory through which the transmission line passes is subject to severe winters, but notwithstanding that fact the station and system gave uninterrupted twenty-four hour service all last winter, which was the first since operations began. The line was patrolled regularly by an attendant, who used a sled for that purpose pulled by dogs.

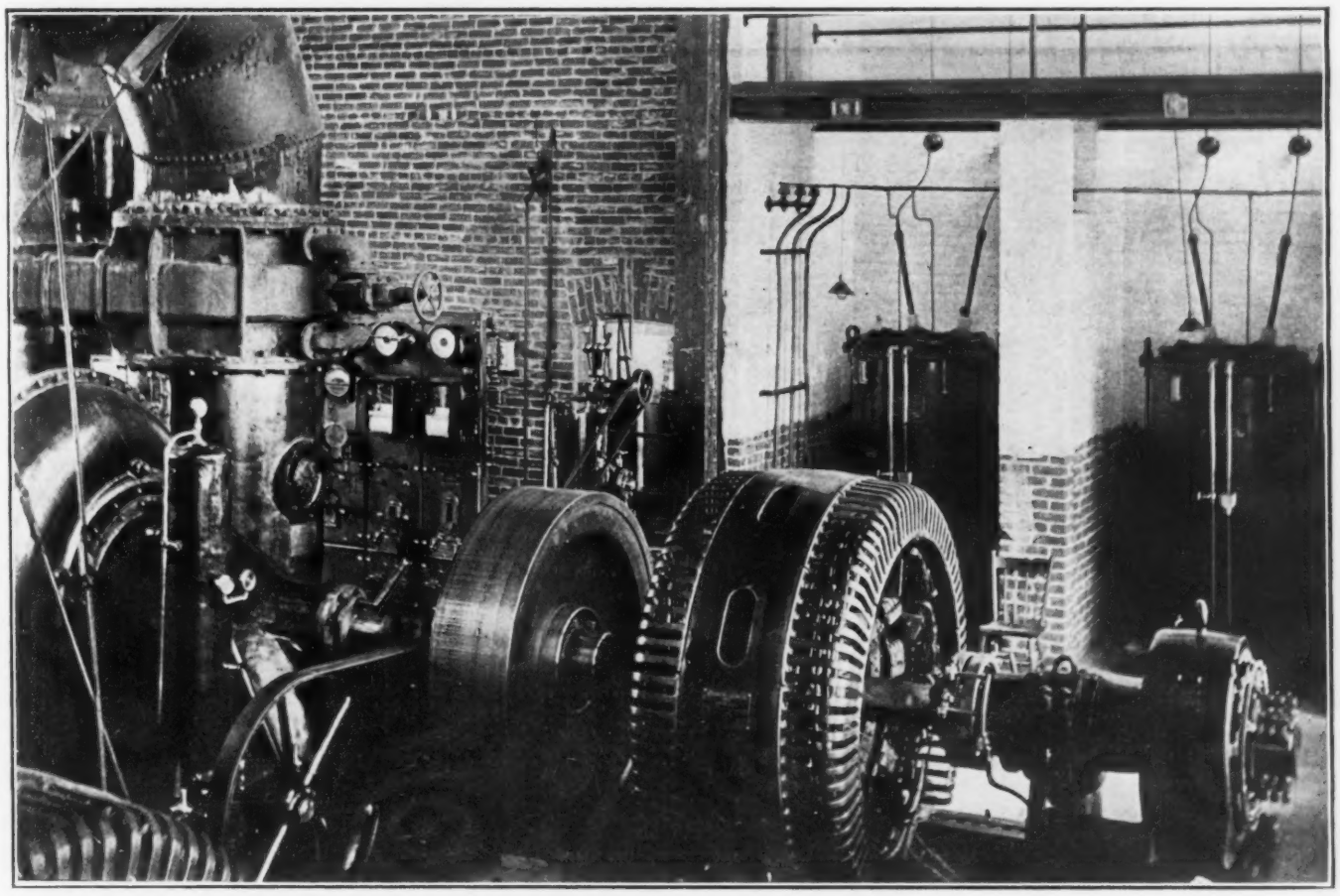


Fig. 1—Interior of Hydroelectric Generating Station of the Nipissing Power Company.

The generating station is located on South River, which rises in a number of small lakes in the Nipissing district in the northern part of Ontario and empties into Lake Nipissing, a large body of water midway between Lake Huron and the Ottawa River. The river is tapped a half mile upstream from the station, where it enters an open canal about 900 ft. long, flowing thence through a 6-ft. wood-stave pipe approximately ½ mile long to the station. A storage pond of 100 acres is provided above the diversion dam in the river. The latter is of reinforced concrete, as are also the portals leading from the open canal to the wood-stave pipe line. The available head at the station is 86 ft.

Plan and interior views of the station are given herewith. The equipment at present provided includes two 925-hp Jenckes turbines, each being equipped with a Lombard governor and 3-ton flywheel and direct-connected to a 450-kw, 2300-volt, 60-cycle, three-phase alternator. On the end of each generator shaft is a 12.5-kw exciter. There is in addition a 35.5-kw induction motor-generator set provided for excitation purposes. The plans call for an additional 450-kw unit and one rated at 900 kw. Facing the generators are compartments in each of which is a 300-kva oil-insulated, water-cooled, delta-connected transformer. These are used to step up the potential from 2200 volts to 22,000 volts, at which pressure the energy is transmitted to North Bay. Adjacent to the transformer compartments and a little to the rear is the electrolytic lightning-arrester equipment, above which in another compartment are the choke coils, disconnecting switches, circuit-breakers, etc., on the outgoing line. The latter is of No. 2 gage aluminum, and after leaving the station crosses the river in a 200-ft. span to an anchor pole on the opposite bank, whence it is carried on regular wooden poles of the type indicated in Fig. 8. A steel cable, grounded at every pole, is carried above the transmission circuit on an extension of the pole as a protection from lightning. A telephone circuit connecting the various parts of the system is also carried on the same pole line below the transmission circuits. The electrical equipment in the station was supplied by the Canadian Westinghouse Company.

Fig. 5 shows a map of the territory through which the transmission line passes. Energy is transmitted to North Bay, to Callander and to Nipissing. The North Bay Light, Heat & Power Company distributes the energy at reduced potential throughout that city and is the chief customer of the transmission company. Prior to the building of the transmission line the North Bay company generated electricity in a steam-driven station and gave only a night serv-

ice. The electrical energy because of this could be used only for lighting circuits. Since the company has contracted with the Nipissing Power Company for energy in bulk a twenty-four-hour service has been inaugurated, rendering the energy available for motor circuits during the day. In addition the Nipissing Power Company reserves the right to supply energy in bulk to other consumers in North Bay provided they require above a certain amount below which the transmission company is obligated not to compete with the local company. The Canadian Pacific Railway Company operates its shops at North Bay with energy purchased from the transmission company.

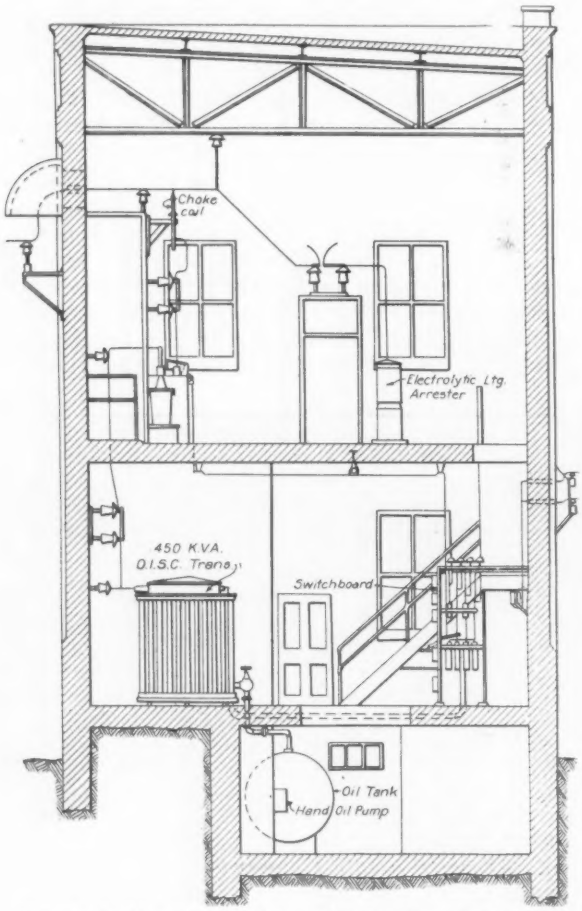



Fig. 2—Sectional Elevation of North Bay Substation.

North Bay has a population of 8000 and is reached by the Canadian Pacific, the Grand Trunk and the Temiskam & Northern Ontario railroads. A cross-sectional elevation of the substation there is shown in Fig. 2. The station has three 450-kva, oil-insulated, self-cooled transformers, two of which are T-connected and step down the potential from 22,000 volts to 2200 volts. The other transformer is held in reserve for emergency use at present and will form one of a set of T-connected units later when the installation is completed.

The North Bay substation has two stories, the upper floor containing the choke coils, disconnecting switches and oil switches on the incoming high-tension circuit, in addition to the lightning-arrester equipment. Single-phase distribution formerly obtained throughout the city, but this has given place to three-phase distribution. At the head of Trout Lake, 3 miles from the city, is the pumping station from which the city water supply is obtained. There is installed a motor-driven pump comprising a Canadian General Electric Company 150-hp motor connected to a centrifugal pump. A 2200-volt line runs from the North Bay substation to the pump house to supply energy to the motor.

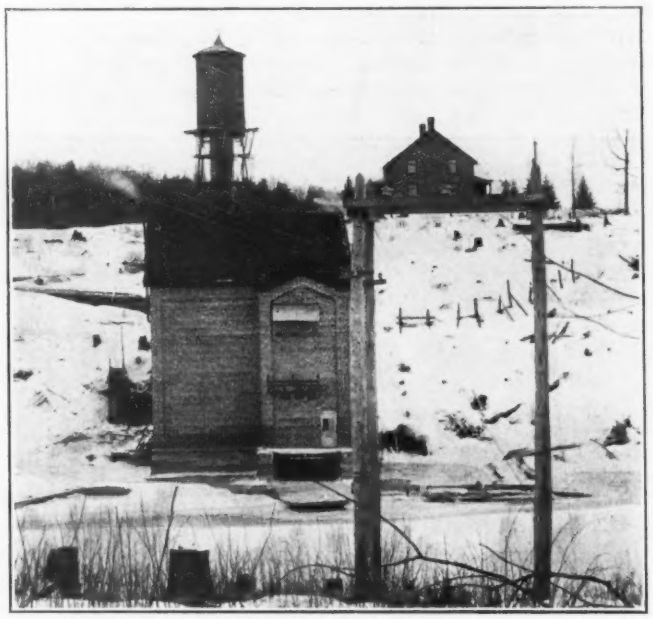


Fig. 4—Generating Station and Standpipe.

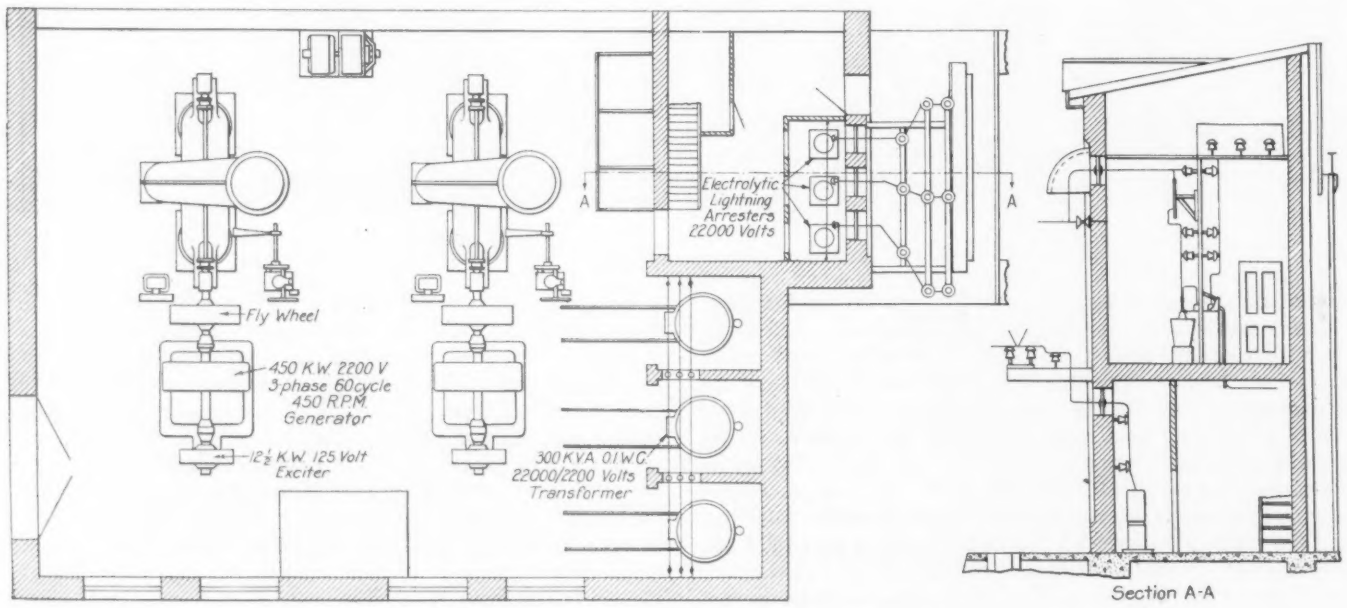



Fig. 3—Plan and Cross-Section of Generating Station.

The load of the Canadian Pacific Railway shops will approximate 100 hp when the installation there is complete.

As will be seen from the map, the main line passes through Callander, which is about midway between the generating

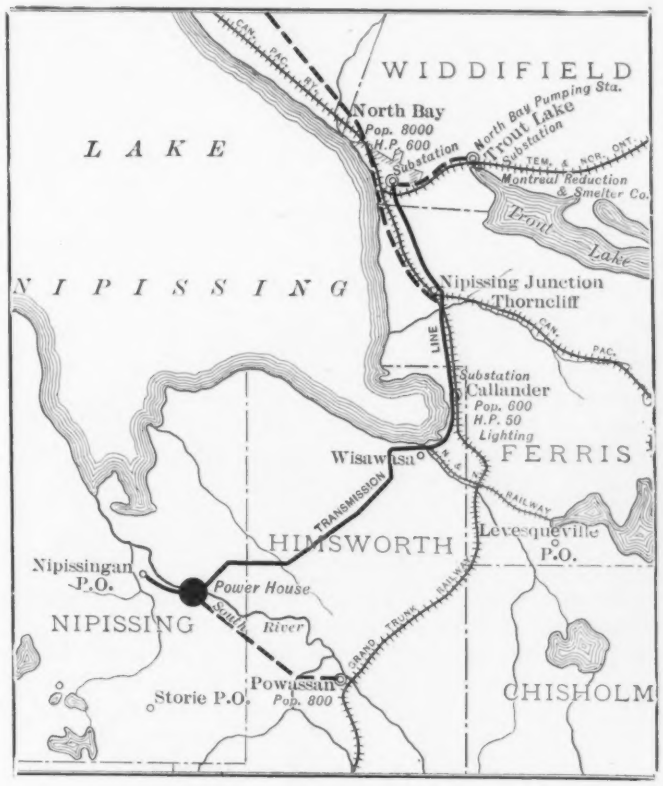



Fig. 5—Map of Transmission System.

station and North Bay. The town has a population of only about 600, so that an independent station would be out of the question. Investment in an expensive substation would also be questionable, but the engineers have apparently solved the problem with the inexpensive substation shown in Fig. 6, which has no regular attendant, but receives periodical visits from the transmission-line patrolman. The substation consists of a galvanized-iron pipe framework

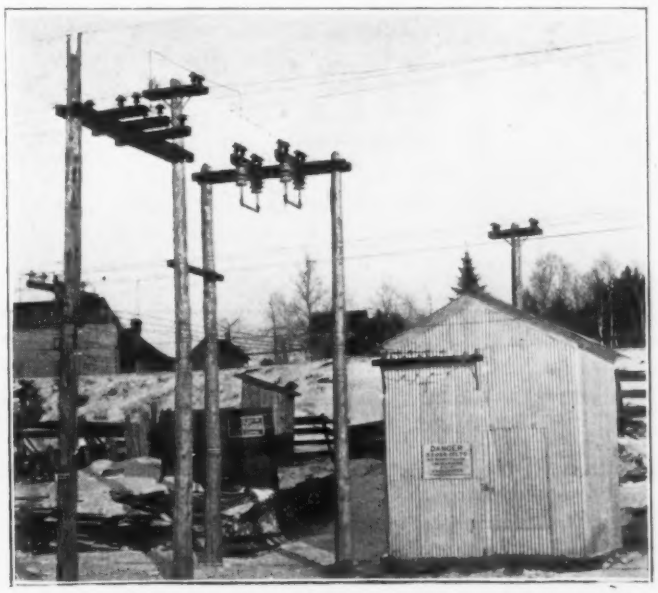


Fig. 6—Exterior of Callander Substation, Showing Control System.

covered with corrugated sheet iron. The building is 13 ft. square and cost complete at Toronto less than $250. It is provided with a concrete floor, giving a fireproof building at a low cost. The equipment consists of one 50-kva, single-phase transformer stepping down the potential from 22,000 volts to 2200 volts. The high-tension circuit is controlled by two downward-pull, outdoor-type, disconnecting switches mounted on a pair of poles outside the station and one pair of fused air-brake switches inside the station. No lightning-arrester equipment is provided on the high-tension side other than a pair of choke coils. The connected load in

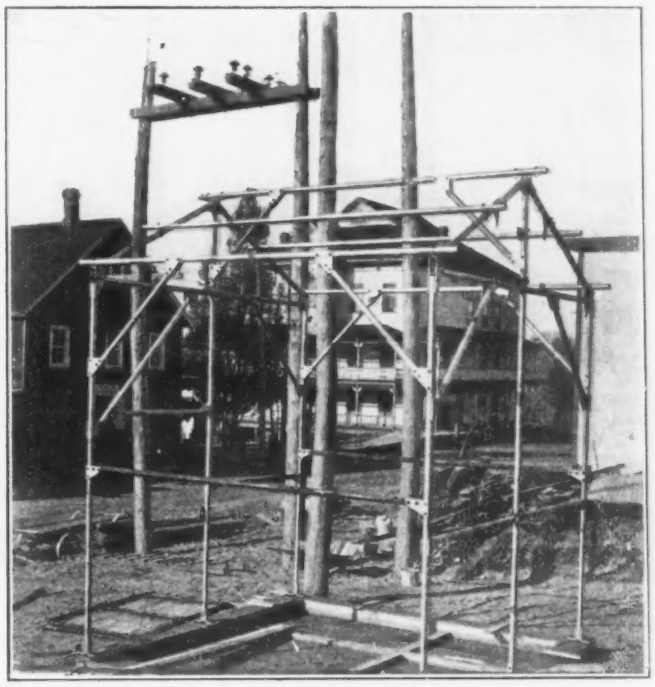


Fig. 7—Framework of Callander Substation.

Callander at present approximates 400 lamps for commercial and residence service and 15 100-watt lamps for street lighting. The station is large enough to house two additional transformers if future motor loads should indicate that three-phase distribution would be desirable.

Three miles from the generating station is the village of Nipissing with a population of not more than 100. The

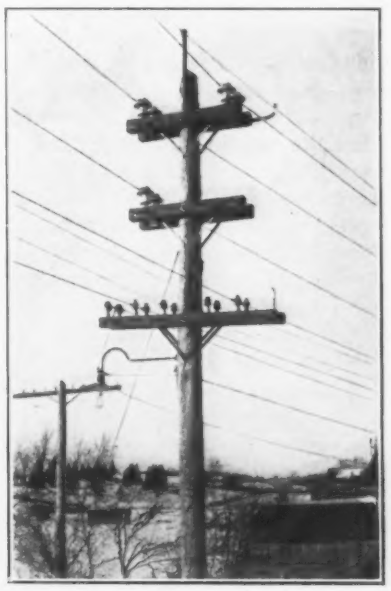


Fig. 8—Pole Line, Showing High and Low-Tension Circuits.

requirements of the village are amply provided for by a 10-hp motor-generator set fed with 2200-volt energy by a single-phase line from the generating station. Six miles west of the generating station on the Grand Trunk Railroad

is the town of Powassan, with a population of approximately 1000, and it is planned to reach that town with a 22,000-volt line tapping the main line and to erect a small substation. The route of the proposed line is indicated on the map shown in Fig. 5.

As outlined in our issue of Jan. 12, the Nipissing Power Company is a subsidiary of the Electric Power Company, Ltd., which controls a number of water-powers in the Trent Valley district. This district embraces nearly all that section of Ontario lying east of Toronto not now supplied from the lines of the Hydroelectric Power Commission of the Province of Ontario.

## THE CALCULATION OF CAPACITY COEFFICIENTS FOR PARALLEL SUSPENDED WIRES.

By Frank F. Fowle.

THE calculation of induction phenomena between parallel suspended wires is assuming an increased importance from an industrial standpoint and merits more attention than it has hitherto received. All such calculations involve fundamentally the coefficients of electrostatic capacity and mutual inductance between the several conductors which form the groups or systems considered. The coefficients of mutual inductance are relatively simple in the respect that the relations between any two conductors are independent of the others and not affected by the addition or withdrawal of conductors in the several groups. This simplicity of relationship does not extend in every case to the coefficients of electrostatic capacity. Such coefficients are always affected theoretically by the addition or withdrawal of conductors. Under some circumstances the theoretical variations may be negligible, but under others far from so. In general, the complexity of relationships increases with the number of conductors present. The formulas expressing these capacity coefficients take a different analytical form with every change in the number of conductors, becoming very unwieldy in some instances. In view of the present importance of having exact expressions for these coefficients under a considerable variety of conditions, it seems worth while to give the full electrical theory of a group of parallel charged wires and deduce the analytical expressions for some of these coefficients in typical cases.

It seems desirable to commence with the general case of a system of $n$ conductors, with charges $q_1$, $q_2$, $q_3$ . . . $q_n$ and potentials $V_1$, $V_2$, $V_3$ . . . $V_n$ respectively. Maxwell shows that the potential of each conductor is a homogeneous linear function of $n$ charges and the whole electric energy of the system is a homogeneous quadratic function of the $n$ charges,[1] expressed in the terms,

$$\begin{aligned} W = {} & \tfrac{1}{2} u_{11} q_1^2 + u_{12} q_1 q_2 + u_{13} q_1 q_3 + \ldots . \\ & + \tfrac{1}{2} u_{22} q_2^2 + u_{23} q_2 q_3 + \ldots . \\ & + \tfrac{1}{2} u_{33} q_3^2 + \ldots . \\ & + \ldots \ldots \\ & + \tfrac{1}{2} u_{nn} q_n^2 \end{aligned} \qquad (1)$$

Under the definition of potential the work done in altering the charge of the system is

$$W = \int V dq \qquad (2)$$

from which

$$V = \frac{dW}{dq} \qquad (3)$$

That is to say, the potential is the partial derivative of the expression for energy with respect to the charge. Applying this to expresssion (1), for each conductor of the system, will produce $n$ linear equations giving the potential of each conductor in terms of the $n$ charges, as follows:

$$\left.\begin{aligned} V_1 &= u_{11} q_1 + u_{21} q_2 + u_{31} q_3 + \ldots + u_{n1} q_n \\ V_2 &= u_{12} q_1 + u_{22} q_2 + u_{32} q_3 + \ldots + u_{n2} q_n \\ V_3 &= u_{13} q_1 + u_{23} q_2 + u_{33} q_3 + \ldots + u_{n3} q_n \\ &\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ V_n &= u_{1n} q_1 + u_{2n} q_2 + u_{3n} q_3 + \ldots + u_{nn} q_n \end{aligned}\right\} \qquad (4)$$

The coefficients of the form $u_{xy}$ are termed coefficients of potential, where the first subscript refers to the charge and the second to the potential. The coefficient of the type $u_{xx}$ denotes the potential of conductor $x$ when its charge is unity and the charges on all other conductors are zero; there are $n$ coefficients of this type, one for each conductor. The type $u_{xy}$ denotes the potential of the conductor $y$ when $x$ receives a unit charge and the charges on all other conductors are zero. It makes, in fact, no difference in what order the subscripts are stated because the relationships are reciprocal, or

$$u_{xy} = u_{yx} \qquad (5)$$

This being true, it follows that the number of different potential coefficients of the type of (5) is $\frac{1}{2} n (n-1)$, or one for each pair of conductors. The nature of these coefficients may be made more clear by the following simple equations relating to a single charged conductor,

$$q = CV \qquad (6)$$

$$V = uq = \left(\frac{1}{C}\right) q \qquad (7)$$

In this simple case the coefficient of potential and the coefficient of capacity have a simple reciprocal relation. But the relationship becomes complicated when two or more conductors comprise the system. By solving equations (4) for $q_1$, $q_2$, $q_3$ . . . $q_n$, a new set of $n$ equations will be obtained of the following form:

$$\left.\begin{aligned} q_1 &= C_{11} V_1 + C_{12} V_2 + C_{13} V_3 + \ldots + C_{1n} V_n \\ q_2 &= C_{21} V_1 + C_{22} V_2 + C_{23} V_3 + \ldots + C_{2n} V_n \\ q_3 &= C_{31} V_1 + C_{32} V_2 + C_{33} V_3 + \ldots + C_{3n} V_n \\ &\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ q_n &= C_{n1} V_1 + C_{n2} V_2 + C_{n3} V_3 + \ldots + C_{nn} V_n \end{aligned}\right\} \qquad (8)$$

A coefficient of the form $C_{xy}$ is a coefficient of capacity, and denotes the charge of conductor $x$ when the potential of $y$ is unity and the potentials of all other conductors are zero. Again there are $n$ coefficients of the type $C_{xx}$ and $\frac{1}{2} n (n-1)$ of the type $C_{xy}$ for the reason as before that

$$C_{xy} = C_{yx} \qquad (9)$$

In the transformation of equations (4) to equations (8) the method of determinants is applicable, as follows:

$$D = \left\{\begin{matrix} u_{11}, & u_{21}, & u_{31} & \ldots & u_{n1} \\ u_{12}, & u_{22}, & u_{32} & \ldots & u_{n2} \\ u_{13}, & u_{23}, & u_{33} & \ldots & u_{n3} \\ \ldots\ldots & \ldots\ldots & \ldots\ldots & \ldots\ldots & \ldots\ldots \\ u_{1n}, & u_{2n}, & u_{3n} & \ldots & u_{nn} \end{matrix}\right\} \qquad (10)$$

$$D_x = \left\{\begin{matrix} u_{11}, & u_{21} & \ldots & V_1 & \ldots & u_{n1} \\ u_{12}, & u_{22} & \ldots & V_2 & \ldots & u_{n2} \\ u_{1x}, & u_{2x} & \ldots & V_x & \ldots & u_{nx} \\ \ldots\ldots & \ldots\ldots & \ldots\ldots & \ldots\ldots & \ldots\ldots & \ldots\ldots \\ u_{1n}, & u_{2n} & \ldots & V_n & \ldots & u_{nn} \end{matrix}\right\} \qquad (11)$$

In (11) the column $V_1$, $V_2$ . . . $V_n$ replaces the column $u_{x_1}$, $u_{x_2}$ . . . $u_{xn}$ in the determinant $D$, given by (10). Then, in general,

$$q_x = \frac{D_x}{D} \qquad (12)$$

Maxwell lays down two fundamental theorems in regard to these coefficients, as follows:

1. The coefficients of potential are all positive, but none of the coefficients $u_{xy}$ is greater than $u_{xx}$ or $u_{yy}$.

2. None of the coefficients of mutual capacity are positive, and the sum of all those belonging to a single conductor is not numerically greater than the coefficient of capacity of that conductor, which is always positive. That is, $C_{xy}$ is always negative and $C_{xx}$ or $C_{yy}$ is always positive; also, in a numerical sense

$$C_{xx} > C_{x_1} + C_{x_2} + C_{x_3} + \ldots + C_{xn} \qquad (13)$$

[1] "Electricity and Magnetism," Vol. I, Chap. 3.

where, of course, $C_{xx}$ does not appear in the right-hand member.

The determination of all the capacity coefficients in any stated problem requires the full transformation of equations (4) to equations (8), using the method of (12). If some particular coefficient is needed, alone, it is not necessary to work out the full solution, however. Assume, for example, that the coefficient $C_{xy}$ is desired. This quantity will appear as the coefficient of $V_y$ in the expression for $q_x$, and, therefore, it can be found by obtaining the proper minor of $D_x$, if $D_x$ is expressed as

$$D_x = \begin{Vmatrix} u_{11} \cdots V_1 \cdots u_{n1} \\ \cdots\cdots\cdots\cdots\cdots \\ u_{1y} \cdots V_y \cdots u_{ny} \\ \cdots\cdots\cdots\cdots\cdots \\ u_{1n} \cdots V_n \cdots u_{nn} \end{Vmatrix} \qquad (14)$$

then the coefficient of $V_y$ is found by taking that minor of $D_x$ which results from erasing the $x^{th}$ column and the $y^{th}$ row, or

$$D_{x'} = (-1)^{x+y} \begin{Vmatrix} u_{11} \cdots u_{n1} \\ \cdots\cdots\cdots \\ \cdots\cdots\cdots \\ u_{1n} \cdots u_{nn} \end{Vmatrix} \qquad (15)$$

and

$$C_{xy} = \frac{D_{x'}}{D} \qquad (16)$$

The last expression is perfectly general for any coefficient of capacity whatever, that is, when $x$ and $y$ have any integral values between 1 and $n$. The numerical value of the coefficient cannot be obtained, however, until the values of the potential coefficients are given. The solution of the general case up to this point applies to any system of charged conductors whatever, but for a system of parallel wires the potential coefficients take a specific analytical form and the considerations hereafter relate entirely to the particular problem here considered.

The form of the potential function for parallel wires, the separations of which are large compared with their diameters, has been given by Heaviside[2], and is deduced as follows. Consider a straight cylindrical wire in free space with a charge $q$ per unit of length; assume also that the effect of the charge is the same as though the charge were concentrated at the axis, corresponding to a linear distribution, which is true for effects at a large distance from the wire compared with its diameter. The force at a point $P$, distant $y$ from the wire in a normal direction, caused by an element of charge $qdx$, is given by (17). Fig. 1 illustrates the relative positions.

$$dF = \frac{qdx}{x^2 + y^2} \qquad (17)$$

But the longitudinal components of all these elementary forces cancel each other when a summation is taken and hence only the normal components of force need be considered. The normal component of (17) is

$$dF' = \frac{qydx}{(x^2 + y^2)^{\frac{3}{2}}} \qquad (18)$$

and the sum of all these normal elementary forces is given by

$$F' = \int_{-\infty}^{+\infty} \frac{qy}{(x^2 + y^2)^{\frac{3}{2}}} dx = \frac{2q}{y} \qquad (19)$$

The force is the negative partial derivative of the potential with respect to the distance, or

$$F = -\frac{dv}{dy} \qquad (20)$$

whence

$$V' = -\int F dy \qquad (21)$$

Substituting for $F$ in (21) the result of (19) gives

$$V' = -\int \frac{2q}{y} dy = 2q \log \frac{a}{y} \qquad (22)$$

where $a$ is an arbitrary constant of integration.

It is a physical impossibility to isolate a single charged conductor from all other conductors; in other words, one must deal necessarily with pairs of conductors and with potential differences between the elements of a pair. In this case if the return conductor is a parallel wire distant $y'$ from the point $P$ and negatively charged with an equal quantity per unit of length, the potential is given by

$$V'' = -2q \log \frac{a'}{y'} \qquad (23)$$

The sum of both potentials is

$$V = V' + V'' = 2q \log \frac{y'}{y} \qquad (24)$$

because the constants of $a$ and $a'$ are seen to be equal when $y$ and $y'$ become indefinitely great, in which case the potential approaches a value of zero.

Returning to the expression for potential as given by (7),

$$V = uq \qquad (25)$$

it becomes apparent that

$$u = 2 \log \frac{y'}{y} \qquad (26)$$

This is the form of the potential coefficient for parallel wires under the conditions previously assumed. The solution of any specific problem is henceforth an application of the general solution just completed by the evaluation of the potential coefficient. Heaviside employed this method in deriving expressions for the capacities of a small group of wires, with earth and metallic return, but not exceeding four in number. The same method has also been used by the author[3] in deriving the mutual capacities between parallel metallic circuits. In general, the problem may be classed under the headings of grounded circuits, metallic circuits and combinations of grounded and metallic circuits. The solution of specific cases will next be taken up under those headings in order.

### GROUNDED CIRCUITS.

The case of grounded circuits is met most extensively in telegraphy, where the number of such circuits on one pole line may reach 100 or more in extreme cases; the average number is much less and forty is near the limit on trunk lines. Such circuits are encountered also in telephony, where they are extensively employed in rural systems; the average number on one pole line is small, comparatively. The simple case of one wire will be considered first.

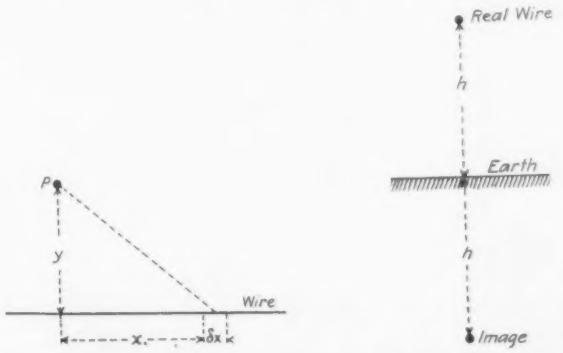






Fig. 1—Geometrical Relations. Fig. 2—Real and Image Wires.

*One Wire.*—A single wire suspended above the earth at a height $h$ is illustrated in Fig. 2, which also shows the electrical image of the real wire, vertically beneath it at a distance $h$ below the earth's surface.

The potential of the wire with respect to the earth, due

[2] "Electrical Papers," Vol. 1, p. 42, "On the Electrostatic Capacity of Suspended Wires."

[3] "The Transposition of Electrical Conductors," *Proceedings* of the American Institute of Electrical Engineers, Vol. XXI.

to a charge $q$ per unit of length, will be found by substituting the wire radius $r$ for $y$ in (26) and $2h$ for $y'$, or

$$V = 2q \log \frac{2h}{r} \tag{27}$$

This follows from the theory of images which shows that the distribution of force and potential in the field above the earth is identical with the distribution which would exist if the earth were removed and a conductor equally but oppositely charged were substituted for it at a point as far below the surface as the real wire is above.

The electrostatic capacity in c.g.s. units is obviously

$$C = \frac{1}{2 \log \frac{2h}{r}} \tag{28}$$

The constant for changing any such expression to microfarads per 1000 ft. or per mile will be given in closing. This deduction assumes that there is no other wire within a very great distance, or many times the value of $h$. In strict theory, of course, it assumes that the given wire and the indefinite expanse of earth are alone in space.

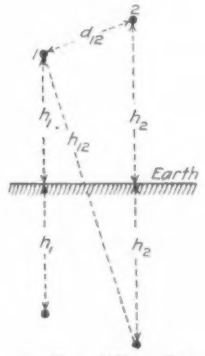



Fig. 3—Two-Wire Ground Return.

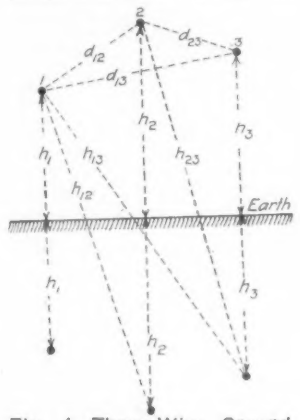



Fig. 4—Three-Wire Ground Return.

*Two Wires.*—The conditions assumed in this case are shown in Fig. 3. When two or more wires are shown hereafter they will be denoted by subscripts in the analytical expressions.

The fundamental equations of the form of (4) in this case are as follows:

$$\left.\begin{aligned} V_1 &= 2q_1 \log \frac{2h_1}{r_1} + 2q_2 \log \frac{h_{12}}{d_{12}} \\ V_2 &= 2q_1 \log \frac{h_{12}}{d_{12}} + 2q_2 \log \frac{2h_2}{r_2} \end{aligned}\right\} \tag{29}$$

The expressions for capacity are nearly obvious; they have the common denominator,

$$D = \begin{Vmatrix} 2 \log \frac{2h_1}{r_1}, & 2 \log \frac{2h_{12}}{d_{12}} \\ 2 \log \frac{h_{12}}{d_{12}}, & 2 \log \frac{2h_2}{r_2} \end{Vmatrix} \tag{30}$$

The minors of $D$ in (30) are obvious and hence

$$C_1 = \frac{2 \log \frac{2h_2}{r_2}}{\left(2 \log \frac{2h_1}{r_1}\right)\left(2 \log \frac{2h_2}{r_2}\right) - \left(2 \log \frac{h_{12}}{d_{12}}\right)^2} \tag{31}$$

$$C_2 = \frac{2 \log \frac{2h_1}{r_1}}{\left(2 \log \frac{2h_1}{r_1}\right)\left(2 \log \frac{2h_2}{r_2}\right) - \left(2 \log \frac{h_{12}}{d_{12}}\right)^2} \tag{32}$$

$$-C_{12} = \frac{2 \log \frac{h_{12}}{d_{12}}}{\left(2 \log \frac{2h_1}{r_1}\right)\left(2 \log \frac{2h_2}{r_2}\right) - \left(2 \log \frac{h_1}{d_{12}}\right)^2} \tag{33}$$

When the wires are of the same size and at an equal height above the earth capacities are given by

$$C_1 = C_2 = \frac{2 \log \frac{2h}{r}}{\left(2 \log \frac{2h}{r}\right)^2 - \left(2 \log \frac{\sqrt{d^2 + 4h^2}}{d}\right)^2} \tag{34}$$

$$-C_{12} = \frac{2 \log \frac{\sqrt{d^2 + 4h^2}}{d}}{\left(2 \log \frac{2h}{r}\right)^2 - \left(2 \log \frac{\sqrt{d^2 + 4h^2}}{d}\right)^2} \tag{35}$$

These expressions indicate how rapidly the complication increases with the number of wires. It soon becomes impossible to use methods of expression such as those just given.

*Three Wires.*—In order to simplify the equations in this case resort may be had to the former symbol for a potential coefficient, observing in general that

$$u_{xy} = 2 \log \frac{h_{xy}}{d_{xy}} \tag{36}$$

$$u_{xx} = 2 \log \frac{2h_x}{r_x} \tag{37}$$

Fig. 4 shows a general arrangement of a three-wire circuit with ground return.

The fundamental equations are given by (38).

$$\left.\begin{aligned} V_1 &= u_{11}q_1 + u_{21}q_2 + u_{31}q_3 \\ V_2 &= u_{12}q_1 + u_{22}q_2 + u_{32}q_3 \\ V_3 &= u_{13}q_1 + u_{23}q_2 + u_{33}q_3 \end{aligned}\right\} \tag{38}$$

Then, since $u_{xy} = u_{yx}$,

$$D = \begin{Vmatrix} u_{11} & u_{12} & u_{13} \\ u_{12} & u_{22} & u_{23} \\ u_{13} & u_{23} & u_{33} \end{Vmatrix} \tag{39}$$

$$D = (u_{11}u_{22}u_{33} + 2u_{12}u_{13}u_{23} - u_{12}^2u_{33} - u_{13}^2u_{22} - u_{23}^2u_{11}) \tag{40}$$

And the capacities are

$$C_1 = \frac{u_{22}u_{33} - u_{23}^2}{D} \tag{41}$$

$$C_2 = \frac{u_{11}u_{33} - u_{13}^2}{D} \tag{42}$$

$$C_3 = \frac{u_{11}u_{22} - u_{12}^2}{D} \tag{43}$$

$$C_{12} = \frac{u_{13}u_{23} - u_{12}u_{33}}{D} \tag{44}$$

$$C_{13} = \frac{u_{12}u_{23} - u_{13}u_{22}}{D} \tag{45}$$

$$C_{23} = \frac{u_{12}u_{13} - u_{23}u_{11}}{D} \tag{46}$$

When the wires are at equal heights above the earth and of equal diameters, or

$$\left.\begin{aligned} h &= h_1 = h_2 = h_3 \\ r &= r_1 = r_2 = r_3 \\ d &= d_{12} = d_{23} = \tfrac{1}{2} d_{13} \end{aligned}\right\} \tag{47}$$

it follows that

$$D = \left[\left(2 \log \frac{2h}{r}\right)^3 + 2\left(2 \log \frac{\sqrt{d^2 + 4h^2}}{d}\right)^2\left(2 \log \frac{\sqrt{d^2 + h^2}}{d}\right) - 2\left(2 \log \frac{\sqrt{d^2 + 4h^2}}{d}\right)^2\left(2 \log \frac{2h}{r}\right) - \left(2 \log \frac{\sqrt{d^2 + h^2}}{d}\right)^2\left(2 \log \frac{2h}{r}\right)\right] \tag{48}$$

$$C_1 = C_3 = \frac{\left(2 \log \frac{2h}{r}\right)^2 - \left(2 \log \frac{\sqrt{d^2 + 4h^2}}{d}\right)}{D} \tag{49}$$

$$C_2 = \frac{\left(2 \log \frac{2h}{r}\right)^2 - \left(2 \log \frac{\sqrt{d^2 + h^2}}{d}\right)^2}{D} \tag{50}$$

$$C_{12} = C_{23} = \frac{\left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)\left(2\log\frac{\sqrt{d^2+h^2}}{d} - 2\log\frac{2h}{r}\right)}{D} \quad (51)$$

$$C_{13} = \frac{\left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)^2 - \left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)\left(2\log\frac{2h}{r}\right)}{D} \quad (52)$$

*General Case.*—When more than three wires are involved the formulas are too cumbersome to give in complete form, but the general solution has already been indicated. Any particular coefficient of capacity is equal to a fraction whose denominator is the determinant $D$ and whose numerator is the minor of $D$ for the corresponding coefficient of potential. This general rule covers all cases of the sort considered up to this point.

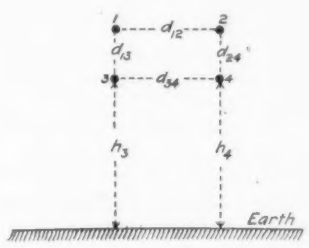



Fig. 5—Four-Wire Ground Return.

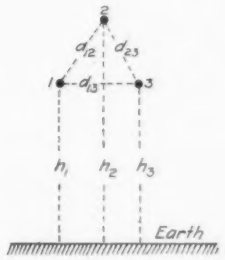



Fig. 6—Three-Phase Line.

The calculation of some typical cases may be of interest. In order to show the effect of adding conductors to the system, the capacities of one, two and three conductors will be calculated, of No. 9 B. & S. gage, each at a height of 20 ft. above the earth and with a spacing of 1 ft. between adjacent conductors. The results in each case are shown in Table I.

TABLE I.—ELECTROSTATIC CAPACITIES IN THE CASE OF ONE, TWO AND THREE NO. 9 B. & S. GAGE WIRES, 20 FT. ABOVE THE EARTH, WITH 1 FT. ADJACENT SPACING. MICROFARADS PER MILE.

| Capacities. | Number of Conductors. | | |
|---|---|---|---|
| | One. | Two. | Three. |
| $C_1$ | 0.009894 | 0.01187 | 0.01236 |
| $C_2$ | ..... | 0.01187 | 0.01320 |
| $C_3$ | ..... | ..... | 0.01236 |
| $-C_{12}$ | ..... | 0.004845 | 0.004045 |
| $-C_{13}$ | ..... | ..... | 0.002447 |
| $-C_{23}$ | ..... | ..... | 0.004045 |

This table shows that the second wire adds 20 per cent to the capacity of the first, and two wires add (to the middle wire) 33 per cent. At the same time the mutual capacities in the case of three wires are less than in the case of two wires. In general, the addition of conductors increases the individual capacities and diminishes the mutual capacities. The calculation of capacities for a larger number of wires is a straightforward operation, but very laborious.

Heaviside calculated a particular case of four wires arranged as shown in Fig. 5 and with the spacings as given in (53).

$$\left.\begin{aligned} h_1 = h_2 &= 3\,1/6\text{ m} \\ h_3 = h_4 &= 2\,5/6\text{ m} \\ d_{12} = d_{34} &= 0.5\text{ m} \\ r_1 = r_2 = r_3 = r_4 &= 2.0\text{ mm} \end{aligned}\right\} \quad (53)$$

In this case the second wire increased the capacity of the first 11 per cent and three wires increased it 24 per cent. It is obvious that the increase is larger with shorter spacings.

The following example is calculated for the case of a three-phase line of No. 2 B. & S. gage wire spaced equilaterally with 60-in. separation, as shown in Fig. 6.

In this case the assumed conditions are given by (54).

$$\left.\begin{aligned} d_{12} = d_{23} = d_{13} &= 60\text{ in.} \\ h_1 = h_3 &= 25\text{ ft.} \\ h_2 &= 29.33\text{ ft.} \\ r_1 = r_2 = r_3 &= 0.129\text{ in.} \end{aligned}\right\} \quad (54)$$

The calculated capacities are given in Table II.

TABLE II.—CAPACITIES FOR FIG. 6 UNDER THE CONDITIONS OF (54). MICROFARADS PER MILE FOR GROUNDED CIRCUITS.

| Capacities. | Numerical Value. |
|---|---|
| $C_1$ | 0.01340 |
| $C_2$ | 0.01319 |
| $C_3$ | 0.01340 |
| $-C_{12}$ | 0.003129 |
| $-C_{13}$ | 0.003025 |
| $-C_{23}$ | 0.003129 |

The upper conductor has slightly less capacity, individual and mutual, than the other two because of its greater elevation. It is evident that the charging currents per phase wire of such a transmission circuit, assuming a star-connected grounded-neutral system, will not be exactly alike, and will be least for the upper conductor. It is obviously necessary to transpose the circuit, as shown in Fig. 7, to obtain a perfect balance.

On account of the line impedance drop it may be necessary to divide the line into several sections of the type shown in Fig. 7. Another interesting case of capacity relations between three wires is illustrated by Fig. 8, which shows the arrangement of three-phase conductors in several transmission lines of a recent type.

The assumed conditions in this case, where the wires lie in the same vertical plane, are given by (55).

$$\left.\begin{aligned} h_1 &= 52\text{ ft.} \\ h_2 &= 46\text{ ft.} \\ h_3 &= 40\text{ ft.} \\ d_{12} = d_{23} &= 6\text{ ft.} \\ d_{13} &= 12\text{ ft.} \\ r_1 = r_2 = r_3 &= 0.1625\text{ in.} \end{aligned}\right\} \quad (55)$$

(No. 0 B. & S. gage.)

The calculated capacities in this case are given in Table III. Both in this example and the preceding one the general formulas for the case of three grounded wires, given by (40) to (46) inclusive, have been employed.

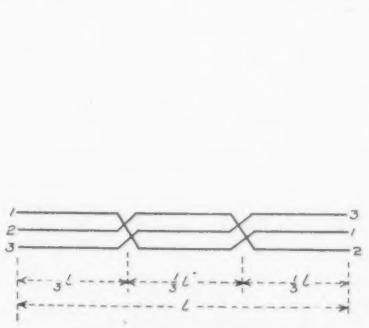



Fig. 7—Three-Phase Line Transposed for Electrostatic Balance.

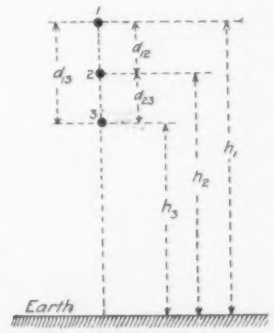



Fig. 8—Three-Phase Transmission Line.

In the last case the middle wire has the largest capacity and the upper one has the least; the latter is about 6.5 per cent less than the former. The mutual capacities are severely unbalanced, as would be expected. A complete balance can be secured only by resorting to the method of transposition shown in Fig. 7.

TABLE III.—CAPACITIES FOR FIG. 8 UNDER THE CONDITIONS OF (55). MICROFARADS PER MILE.

| Capacities. | Numerical Values. |
|---|---|
| $C_1$ | 0.01256 |
| $C_2$ | 0.01342 |
| $C_3$ | 0.01287 |
| $-C_{12}$ | 0.003668 |
| $-C_{13}$ | 0.001980 |
| $-C_{23}$ | 0.003536 |

In a subsequent issue solutions will be given of the problems involved in various forms of metallic circuits.

## A GRAPHICAL METHOD FOR FINDING THE SAG AND TENSION IN WIRE SPANS.

By R. S. Brown.

IN the *Electrical World* for Jan. 12, 1907, Dr. H. Pender gave a formula for calculating the relation between temperature, tension and deflection in any span of a pole line. His formula gives quite accurate results and is probably more widely used than any other. It is a cubic equation in tension and deflection and hence must be used by substituting values for these variables and solving for temperature. To overcome this irreversible feature and at the same time do away with the computation involved, a graphical solution of the equation has been devised and is presented herewith.

The charts given here are constructed for the two most common conductor materials, copper and aluminum, using the values for the physical constants of these metals which seem most authentic. The method of constructing the curves is quite simple and a brief explanation of the process will be given so that one may plot curves for any material, using whatever constants he sees fit.

Dr. Pender's formula is:

$$t - t_o = \frac{6\,m^2}{a}\left(\frac{r^2l^2}{T^2} - \frac{r_o^2l^2}{T_o^2}\right) + \frac{1}{aM}(T_o - T) \qquad (1)$$

and

$$D = 1.5\,m\frac{rl^2}{T} \qquad (2)$$

Where

$m$ = density of wire in lb. per cu. in.

$a$ = coefficient of linear expansion per degree Fahr.

$M$ = modulus of elasticity in lb. per sq. in.

The values used here are:

| | Cu. | Al. |
|---|---|---|
| $m$ | 0.321 | 0.0967 |
| $a$ | $9.6 \times 10^{-6}$ | $12.8 \times 10^{-6}$ |
| $M$ | $16 \times 10^6$ | $9 \times 10^6$ |

$t$ = temperature in degrees Fahr.

$l$ = length of span in ft.

$r$ = ratio of resultant force acting on the wire to the weight of wire.

$D$ = deflection or sag at center of span in ft.

The resultant force acting on the wire consists of a horizontal component due to wind pressure and a vertical component due to weight of wire and sleet load. For no wind and no ice $r = 1$. Mr. H. W. Buck gives the following formula for calculating wind pressure:

$$p = 0.00021\,V^2d$$

where $p$ is the pressure in pounds per foot of wire, $V$ is the actual wind velocity in miles per hour and $d$ is the diameter of the sleet-covered wire. The maximum value of $r$ is from 2 to 4 for practical conditions in temperate climates. The subscripts zero refer to assumed values of the variables which fix the curve. They are usually taken at the worst conditions. Thus, $t_o$ is the temperature at which wind, ice and contraction combine most strongly to stress the wire. $T_o$ is the maximum allowable tension and $r_o$ is the value of $r$ under these worst conditions.

From equation (1) it will be seen that fixing the value of $t_o$, $T_o$ $(r_ol)$ and $(rl)$ determines a curve in $t$ and $T$. By varying $(rl)$ there is obtained a family of curves and By varying $t_o$, $T_o$ or $(r_ol)$ the origin of this family of curves is moved up or down the temperature axis.

### COMBINATION OF CURVES.

The tension curves on the chart are the locus of the equation,

$$t = \frac{6\,m^2r^2l^2}{aT^2} - \frac{T}{aM} \qquad (3)$$

where $(rl)$ is varied by uniform steps of 100. To plot them let $rl = 1000$ and plot the resulting curve. Draw any number of parallel straight lines having the slope $\left(-\frac{1}{aM}\right)$—that is, parallel to the asymptote. By means of dividers divide the part of these lines included between the $(t)$ axis and the curve into ten equal parts and extend these divisions along the lines as far as is desired to the right of the curve. The first point on each line will correspond to $rl = 100$, the second to $rl = 200$ and so on. Through the various points corresponding to the same value of $rl$ draw the remaining tension curves. For the lower part of the curves it may be necessary to compute a few points on the $rl = 100$ curve.

The deflection curves are the locus of the equation,

$$t = \frac{8\,D^2}{ar^2l^2} - \frac{1.5\,mr^2l^2}{aMD} \qquad (4)$$

where $rl$ is varied by uniform steps of 100. To plot them first plot carefully the equation when $rl = 1000$. Then draw in any number of straight lines having the equation

$$t = \frac{8\,C^2}{3\,a} - \frac{1.5\,mD}{aC^2M}$$

where $C = \frac{D}{rl}$ and has different values assigned to it at random. Divide the part of these lines included between the $(t)$ axis and the curve into ten equal parts and draw in the deflection curves in a manner similar to that in which the tension curves were drawn. When all the curves are in erase the temperature scale, as it is of no further use, and construct a temperature scale on a strip of cardboard, the divisions of which have the same spacing as those on the original temperature scale.

### USE OF THE CHART.

To use the curves proceed as follows:

Calculate the value of $r_o$ as indicated above.

Select a tension curve marked with the product $r_ol$ and find the intersection of this curve with the ordinate corresponding to the value of $T_o$, the tension desired at $t_o$.

Lay the movable scale along the $(t)$ axis so that the temperature $t_o$ on the scale falls opposite this intersection. The value of tension at any temperature may then be read directly from the curves.

The deflection is read from the deflection curves without moving the scale from its first position. The true deflection is the value read from the curve marked with $(rl)$, divided by $r$. The deflection is usually wanted when $r = 1$ and in this case is read directly from the curve marked with length of span.

In case the points of support are not on the same level the deflection $D_2$ below the higher support is found by means of an auxiliary formula given by Dr. Pender,

$$D_2 = D\left(1 + \frac{h}{4D}\right)^2 \qquad (5)$$

where $h$ is the difference in height of the two points of support and $D$ is the deflection for a level span of equal length as found from the chart.

**EXAMPLES.**

Ex. 1.—400-ft. span of aluminum.

When

$$t_o = 15 \text{ deg. Fahr.}$$
$$T_o = 10{,}000 \text{ lb. per sq. in.}$$
$$r_o = 3$$

Find $T$ and $D$ at 70 deg. when $r = 1$ and $D$ at 15 deg. when $r = r_o = 3$.

Answer:

$T$ at 70 deg. = 3400 lb. per sq. in.

$D$ at 70 deg. = 6.8 ft.

$$D \text{ at } 15 \text{ deg.} = \frac{21}{3} = 7 \text{ ft.}$$

Ex. 2.—1000-ft. span of copper.

When

$$t_o = 0 \text{ deg. Fahr.}$$
$$D = 24 \text{ ft.}$$
$$r_o = 1.5$$

Find $T$ at 0 deg. when $r = r_o = 1.5$.

Answer: Place the zero of the temperature scale opposite the point on the 1500 deflection curve cut by the ordinate $D = 1.5 \times 24 = 36$.

$T$ at 0 deg. = 30,000 lb. per sq. in.

## REGENERATIVE CONTROL FROM A COMMERCIAL VIEWPOINT.

By J. Gustaf V. Lang.

THE series motor, which is the adopted standard for traction work, lacks the reversible characteristic which is the fundamental basis of regeneration. Moreover, the method used for the control of the standard motor is partly antagonistic to the principle of regeneration, namely, the control by resistances in the armature circuits.

In the same way as it is essential to accelerate a vehicle step by step, it is of importance to have the retardation under control by successive degrees. The graduated acceleration has been and generally is to-day accomplished by the use of resistances in the armature circuit. This has been for many years the only satisfactory way, but, although it is simple, it is far from efficient. Developments during the last six years have made practical other means for the control of series motors whereby the efficiency is greatly improved. When Mr. Robert Lundell started about ten years ago to give the problem of regenerative control serious and active consideration he had to face not only a departure from the accepted standard of traction motor, but also from the standard method of control.

Certain economies obtainable by means of regenerative control of railway motors were discussed by the present writer in the *Electrical World* dated March 30, 1911. Below is given a description of schemes that were employed successfully by Mr. Lundell in practically applying regenerative control in railway service.

The motor for regenerative control must be given a shunt characteristic. The counter emf of the equipment must be capable of being raised above the line voltage step by step according to the retardation desired and corresponding to the speed. Either a shunt-connected field winding or some form of independent field excitation can be used for the production of a shunt characteristic. The control of the counter emf is a more difficult problem. A certain field strength would have a corresponding speed at which regeneration would cease. A resistance in the armature circuit would not change this limit, but it would reduce the current and waste a considerable part of the converted energy. It is necessary to obtain a variation of the field strength, but this involves difficulties with regard to commutation. It is desirable to get as low a braking speed as possible, which means a slow-running motor, and this in turn cannot be obtained without increasing the size of the motor, which is prohibitive, or without decreasing the permissible output of the motor.

These considerations led Lundell to adopt the double-series-parallel principle in combination with a speed variation of 80 per cent by means of field regulation. The motors designed on these lines were probably the first multiple-speed motors capable of substantial speed variation by means of field control. The double-series paralleling enabled him to maintain the motor output at full load when all four armature circuits were in parallel, to get a low minimum braking speed when all four armature circuits were arranged in series, and to obtain all the control desired both for acceleration and retardation practically without the use of any added resistance in the armature circuit.

It has seemed necessary to bring out the reason for the adoption of the double-series-parallel system in the early development of the regenerative traction idea for the purpose of explaining the fact that the tests which will be referred to have been made with double-series-parallel equipments. The question of the advisability of a return to the single-series-parallel system will be discussed later, as will the modifications such a change would bring with it in respect to regenerative saving as determined from the experience gained with double-series-parallel systems.

### TEST AT NEWCASTLE-ON-TYNE IN 1902.

The first thorough test on a regenerative equipment under practical conditions was carried out at Newcastle-on-Tyne, where two double commutator motors were installed and test runs were made on all the routes of the town. A similar car with a standard equipment was also run. Indicating wattmeters, recording voltmeters and ammeters and speedometers were used. Special tests were run up and down one of the steepest hills and practical results were obtained which checked closely with theoretical calculations.

TABLE I.—COMPARISON OF ENERGY CONSUMPTION OF REGENERATIVE EQUIPMENT AND STANDARD EQUIPMENT, NEWCASTLE-ON-TYNE, 1902.

| Route. | Length in Miles. | Stops per Mile. | Regenerative Equipment. | | | | Standard Equipment. | |
|---|---|---|---|---|---|---|---|---|
| | | | Speed. | Input. | Output. | Net. | Speed. | Input Kw-Hours. |
| Fairly level, including 500 yd. of 1 in 14..... | 7.8 | 4.2 | 8.5 | 6.04 | 1.60 | 4.44 | 8.5 | 7.03 |
| Fairly level.. | 3.66 | 3.5 | 7.32 | 3.42 | .58 | 2.84 | 8.44 | 3.52 |
| *Includes the steepest hill. | 2.92 | 5 | 7 | 3.57 | 1.1 | 2.47 | 10.3 | 3.58 |
| †Up hill..... | 1.17 | 3.4 | 7.8 | 2.45 | .03 | 2.42 | 7.02 | 2.32 |
| †Down hill.... | 1.17 | 2.6 | 7.0 | .21 | .67 | —.46 | 10.00 | .16 |
| Total..... | 2.34 | 3.0 | 7.4 | 2.66 | .7 | 1.96 | 8.25 | 2.48 |
| Total..... | 16.7 | 4 | 8 | 15.7 | 4.0 | 11.7 | 8.7 | 16.6 |

Weight of each car, 9.2 tons.
Each trip was a complete return trip.
*The speed difference is mainly due to the hill. Consumption not much affected.
†Both uphill and return is shown. It is evident that the difference in downhill speed is of practically no consequence.

The average results of the four tests recorded in Table I show that, covering a distance of 16.7 miles with four stops per mile at an average speed of the regenerative equipment of 8 miles per hour against 8.7 of the standard equipment, the input to the regenerative car was 15.7 kw-hours and that to the standard car 16.6 kw-hours. The output from the regenerative car measured 4 kw-hours, making the net input to the regenerative car 11.7 kw-hours. The regenerative saving of 4 kw-hours is 24 per cent of the input to the standard car. The weight of the two cars was approximately the same, 9.2 tons. Working out the probable re-

sult according to the method suggested by the writer, the input to the standard equipment, measured at the car, equals about 1 kw-hour per car-mile. Assuming the motor efficiency to be 70 per cent, the mechanical output would be equivalent to 0.7 kw-hour. The tractive resistance figured

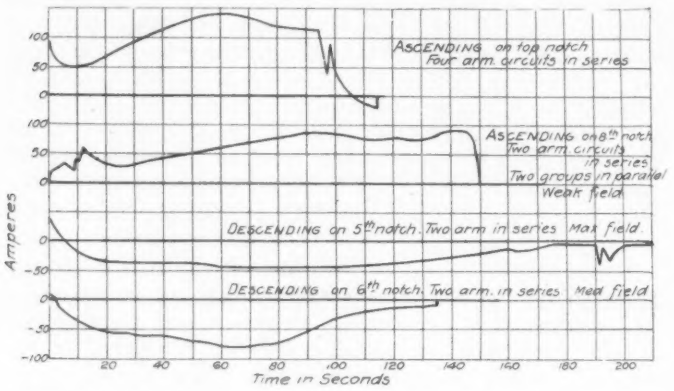

Ascending on top notch. Four arm circuits in series
Ascending on 6th notch. Two arm circuits in series. Two groups in parallel. Weak field.
Descending on 5th notch. Two arm in series. Max. field.
Descending on 6th notch. Two arm in series. Med. field.
Amperes
Time in Seconds

**Fig. 1—Hill Test. Average Grade 5 per Cent. Length 2000 Ft.**

at 19 lb. per ton would consume 0.35 kw-hour, leaving 0.35 kw-hour representing the kinetic and potential energy, which if transformed at an efficiency of 70 per cent would mean a return of 0.245 kw-hour; in other words, a saving of about 24 per cent.

One test consisted in ascending and descending one of the steepest hills. The total vertical lift amounted to about 100 ft. and the distance measured 2000 ft. The car was loaded up to weigh approximately 12.5 tons. The poten-

| | Average Speed. | Kw-hours Recording Wattmeter. | Kw-hours Watt-hour Meter. |
|---|---|---|---|
| Ascending | 15.3 | 1.4 | 1.425 |
| Descending | 12.2 | 0.845 | 0.705 |

tial energy stored up in ascending consequently was 2,800,000 ft.-pounds, or 1.06 kw-hours.

Figuring the tractive resistance at 19 lb. per ton, the hauling energy would be $19 \times 12.5 \times 2000$ ft.-pounds, or 0.180 kw-hour. Assuming the motor efficiency at 80 per cent, which is a very close approximation for the regenera-

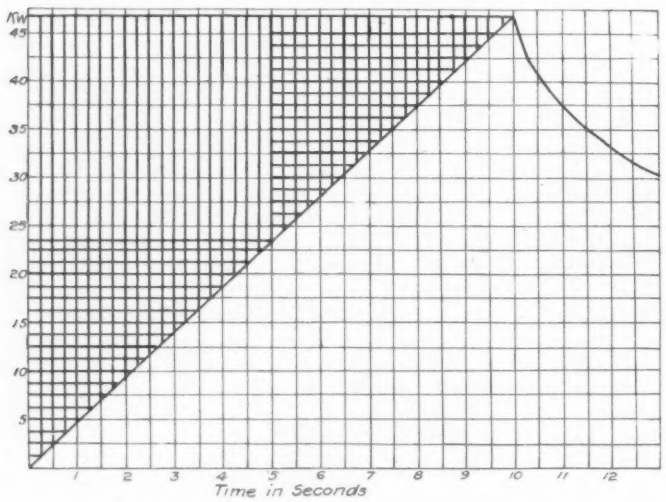



**Fig. 2—Resistance Losses During Acceleration by Rheostatic and Single-Series-Parallel Control.**

tive equipment in question, the total input to be expected works out at 1.55 kw-hours for the ascent.

The potential energy less the hauling energy leaves 0.88 kw-hour to be converted. If the regenerative efficiency should average 80 per cent the return would be 0.7 kw-hour.

The actual figures obtained are given in the table printed above.

These figures represent average from two tests on different notches, as shown in the curves of ammeter readings, Fig. 1.

It should be remembered that both the double-series paralleling and the absence of armature resistances ought to bring about a decided increase in accelerating efficiency and also in the efficiency of intermediate notches, on which city traffic often compels relatively long runs. The losses during the accelerating period can best be studied by the use of the graphical representations given by Mr. H. M. Hobart, which are here reproduced as Figs. 2 and 3.

With a single motor, controlled by resistances only, the line voltage must be balanced practically entirely by the resistance in the armature circuit at the moment of starting, and as the motor reaches the full speed and the resistance is cut out less and less of the voltage is absorbed by the resistance. Consequently the energy represented by the area of the shaded triangle represents loss in resistance, and, as will be seen, this represents about half of the total input.

The series-parallel method cuts the line voltage in half, so to speak, and the resistance losses are represented by two smaller triangles, each having only a quarter of the area of the large one. The loss in resistance is, therefore, only one-third of the total input. Or, to express the same thing differently, the series-parallel method effects a saving in input of 25 per cent over the plain resistance method.

The double-series-parallel method provides the equivalent of still a lower voltage, in other words, cuts the lower triangle of the single-series-parallel method and substitutes two smaller triangles in place of it, each of one-fourth the area of the original one. Thus the double-series-parallel method effects a saving of a little more than 8 per cent over the single-series-parallel method.

The introduction of field control, however, reduces the resistance losses to practically nil. Only at the very start is there a resistance in the circuit. There are some additional losses in the motors, but still one would be justified in looking for from 25 per cent to 30 per cent saving during the accelerating period out of the theoretically possible 33 1/3 per cent.

Such a saving would mean a difference in gross input of

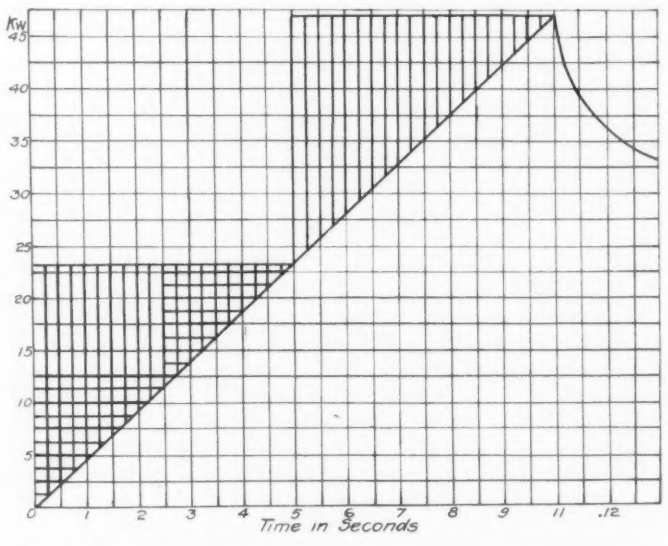



**Fig. 3—Resistance Losses During Acceleration by Double-Series-Parallel Control.**

at least 10 per cent with four stops per mile. The test above referred to does not show more than about 5 per cent saving in input of the double-series-parallel equipment without armature resistances as compared with the standard single-series-parallel equipment with armature resistances. This discrepancy was explained by the low efficiency of the motors at light loads due to the shunt-field losses.

### TEST AT NEWCASTLE-ON-TYNE IN 1903.

About a year and a half later an equipment was designed and built incorporating the idea of retaining the series characteristic during propulsion and giving the equipment a shunt characteristic during retardation only. The purpose of this was to avoid the losses in the shunt coils at low loads and thus get the full benefit of the increased efficiency due to the absence of armature resistances. The speed control was obtained by field regulation, but the field during propulsion was excited entirely by the armature current, part of which was diverted for weakening the field according to the speed changes desired. A special switch was provided to rearrange certain of the sections of the field coils so that they could be used as a shunt-field circuit for retardation.

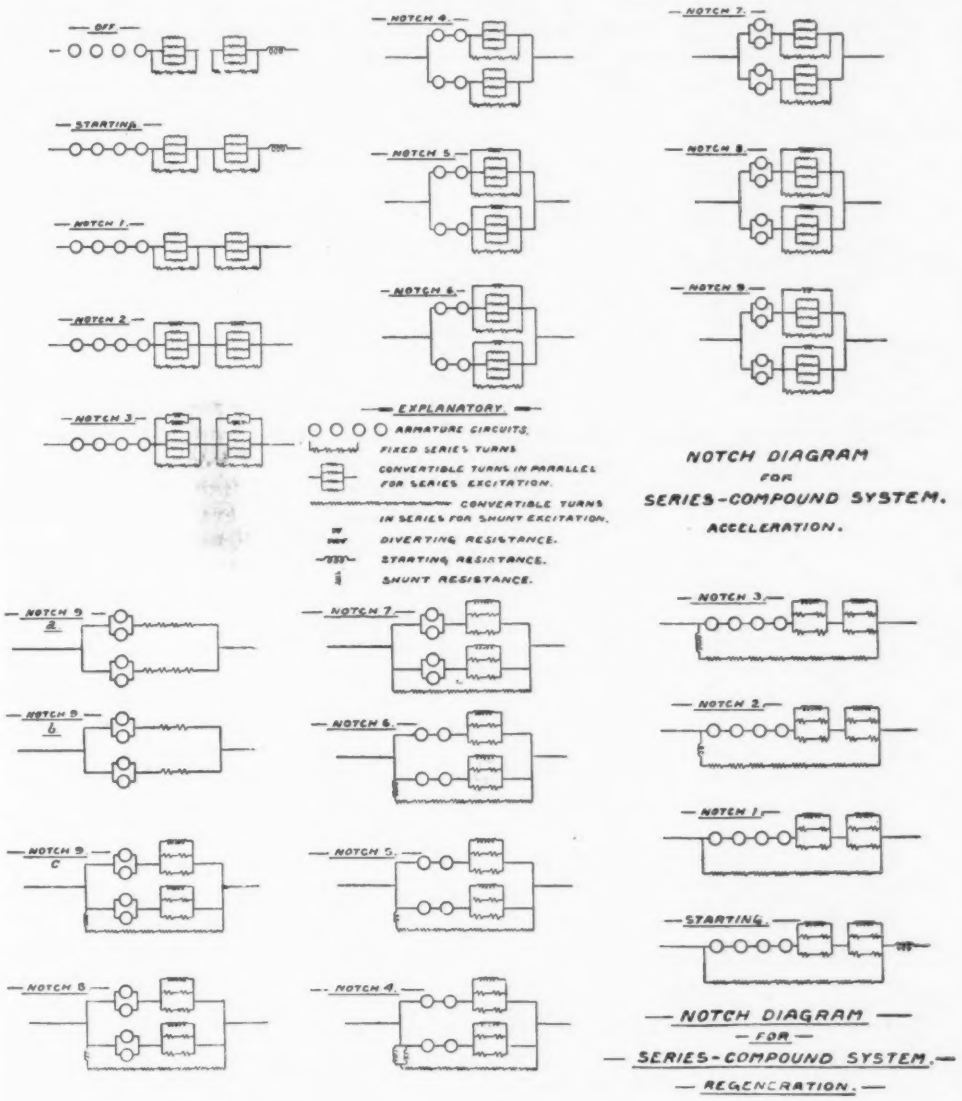



Fig. 4—Arrangement of the Armature and Field Coils on the Different Notches.

The diagram in Fig. 4 shows the arrangement of the armature and field coils on the different notches. To get a more accurate idea of the saving during the accelerating period to be looked for with this new equipment as compared with the standard single-series-parallel equipment the curves of Figs. 5 and 6 were calculated on the basis of equal maximum acceleration and equal conditions. It will be seen that a considerable saving is effected during the acceleration period. On each of the above diagrams will be found a curve of the integrated energy area corresponding to the input, as well as another curve indicating the usefully employed energy—that is, the amount needed to overcome the tractive resistance together with that stored as kinetic energy corresponding to the speed attained.

By comparison it is found that corresponding to a usefully employed energy consumption of 0.048 kw-hour the input to the regenerative equipment is 0.066 kw-hour and to the standard equipment 0.090 kw-hour. This indicates a saving of 27 per cent, which agrees fairly well with the conclusions reached from the graphical representations which have been referred to in this article.

This new equipment was tested at Newcastle in December, 1903, and particular attention was given to the determination of increased efficiency during propulsion. The results are summarized in the table printed below.

A double-bogie car weighing 11.4 tons was used. The figures given are the average from three runs with the regenerative equipment and from two runs with the standard. The route was comparatively level, 2.93 miles long. State of road, very thick, greasy mud. The saving in gross input was 8 per cent in the case of four stops per mile and 12 per cent in the case of eight stops per mile.

The regenerative saving in each of the two cases was 15.2 per cent and 17.9 per cent of the energy consumption of the standard equipment. These results compare favorably with those obtained in the previous test on the "fairly level" route, particularly when the bad condition of the track is taken into consideration. The input to the standard equipment was considerably higher in this test than in the previous when figured per ton-mile, and the only explanation is the condition of the track. As a result the regenerative saving will be smaller in proportion when figured as a percentage on the input to the standard car.

This test is particularly interesting as a means for studying the influence of the number of stops per mile on the energy consumption of both the standard and the regenerative equipments. The curves of Fig. 7, plotted from the results of the tests and with the energy consumption at no stop per mile deduced from the other values by subtracting the value of the kinetic energy for four or eight stops per mile, show how important regeneration becomes even on very level routes as soon as the

| | Four Stops per Mile. | | Eight Stops per Mile. | |
|---|---|---|---|---|
| | Regenerative. | Standard. | Regenerative. | Standard. |
| Speed, miles per hour | 8.05 | 8.3 | 7.95 | 7.8 |
| Car-miles | 17.6 | 11.7 | 17.6 | 11.7 |
| Input, kw-hours | 22.3 | 16.2 | 25.7 | 19.6 |
| Output, kw-hours | 3.7 | ..... | 5.3 | ..... |
| Net input | 18.6 | 16.2 | 20.4 | 19.6 |
| Gross input per car-mile | 1.27 | 1.38 | 1.46 | 1.68 |
| Net input per car-mile | 1.06 | 1.38 | 1.16 | 1.68 |

traffic necessitates comparatively high schedule speeds and frequent stops.

Having thus established the feasibility of obtaining regeneration without imparing the decided improvement in accelerating efficiency and efficiency on intermediate run-

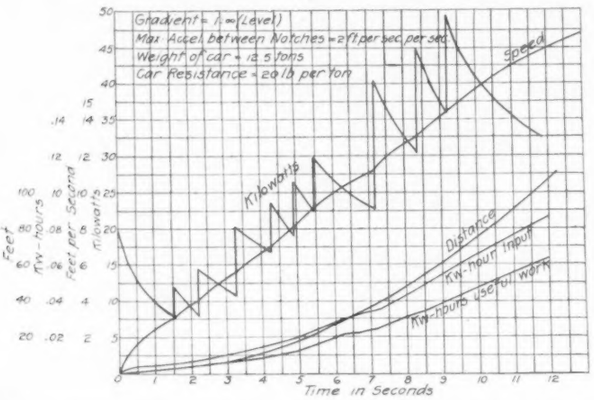



Fig. 5—Calculated Acceleration for Double-Series Parallel with Field Control.

ning notches due to the practical elimination of armature resistances, a number of equipments were designed and built incorporating the ideas tested at this last Newcastle trial. Several of these equipments were installed and

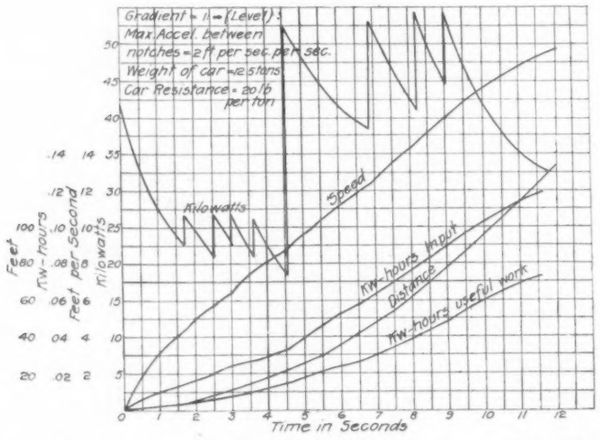



Fig. 6—Calculated Acceleration for Double-Series Parallel with Field Control.

tested both at Norwich, in England, and at Solingen, in Germany.

In subsequent articles details of these tests will be given to show the practical value of regeneration, estimates will

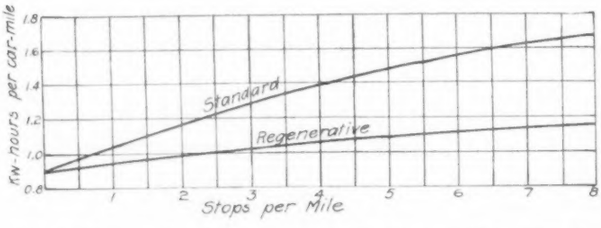



Fig. 7—Comparative Increse of Energy Consumption with Increase of Number of Stops.

be made of the comparative costs of standard single-series-parallel and double-series-parallel equipments, and the cost of maintenance of a standard equipment will be compared with that for single-series-parallel and double-series-parallel equipments.

## THE OPERATION OF INDUCTIVELY COUPLED RECEIVING SETS IN WIRELESS TELEGRAPHY.

An account of a series of investigations on the operation of inductive tuners in wireless-telegraph receiving sets is given by Lieut. J. O. Mauborgue, Third Infantry, United States Army, in the report of technical conference No. 14 of the Army Signal Schools of Fort Leavenworth, Kan. The tests described included use of the inductive tuner alone and with variable air condenser in secondary, in series with the primary and in parallel with the primary. From characteristics shown by curves plotted between wave-lengths and coupling ratios, the author concludes as follows: Varying the coupling varies the wave-length. Regardless of coupling used, apparatus is always tuned to two wave-lengths at same time. This double periodicity was illustrated by pulling out the secondary coil to a position "30," when the equipment is tuned to both a 1355-m and a 490-m wave. Use can be made of this double frequency in avoiding a station operating in the lower register while continuing to listen to the desired station by changing primary inductance. In tuning with an inductive tuner alone the longest wave-length is obtained with the primary and secondary inductances at a maximum and the coupling as close as possible. With a variable condenser in series with the primary inductance loosening the coupling causes a rapid drop in the wave-lengths of the higher curve and a similar rise in the lower curve, enabling the operator to eliminate an undesired station with a short wave-length. In conclusion the author declares that the most selective device would be an inductive tuner having its primary variable by single turns, and with a variable condenser capable of being connected in either parallel or series with the primary, and a variable condenser of small value around the secondary.

## DETERMINATION OF THE EFFICIENCY OF A SMALL HYDROELECTRIC GENERATING STATION.

The efficiency of small electric generating plants driven by waterwheels is a matter of considerable importance. The revenue derived by such stations from operation is often almost insignificant in comparison with the annual income of plants serving even towns of a few thousand inhabitants, but in view of the large number of such stations in service and the value of water utilized in individual cases the problems of efficient service are of wide interest and significance. In the following paragraphs are outlined the methods and results of an efficiency determination made with unusual care upon a plant of 75-kw rating located in a factory village of 2500 inhabitants.

The chief industry of the town was the manufacture of shoes, and the plant was originally built by the owner of a shoe factory for his lighting and power service. The site of an old sawmill was used, together with a canal which had served the former. The plant was located half a mile from the factory and supplied power and lighting service generally throughout the village, of course, in very small quantities. The stream from which the water supply was drawn was without sufficient storage capacity to carry the plant through the year, so the installation was completed by a supplementary steam plant consisting of two 100-hp horizontal return tubular boilers and a 60-hp engine. The hydraulic equipment consisted of a 15-in. and an 18-in. set of wheels mounted on the same horizontal shaft in one casing, but with two separate gates. The waterwheels were controlled by a Lombard governor and the generator was a 75-kw, two-phase, 60-cycle Westinghouse machine, with exciter and Tirrill voltage regulator. The water supply was drawn from the river by a canal about 2500 ft. long

and an effective head of 25 ft. was obtained on the wheels.

As the draft tube equipment exhausted directly into the main stream it was impossible to measure the water after it left the wheels. A weir was accordingly built in the canal. The efficiency curve of the generator was known from previous tests, and the electrical output was measured in the usual way. Belt losses and losses in the governor were included in the determination of power delivered to the generator. The weir was built with two end contractions and a notch with a width of 6 ft., allowing for a head over it of about 1 ft. The canal at the weir site was of trapezoidal section and 13 ft. wide, with a rock and gravel bottom. It was necessary to drain the canal while building the weir, this work being done on a Sunday, while the station was shut down.

In the weir construction a framework was made by driving in vertically five 2-in. x 4-in. joists and then fastening horizontal pieces of the same size against them on the upstream side. The framing was well braced on the downstream side. On the upstream side there were driven vertically ⅞-in. matched boards, nailed to the cross pieces, leaving a notch 6 ft. 2 in. wide. The bottom of the notch was about 30 in. above the bed of the stream. The matched boards gave a very tight construction, while the bottom and sides were made tight by filling in with clay and turf. In order to obtain sharp edges on the notch ⅛-in. x 3-in. iron plates were attached on the upstream side, overlapping the notch so that its width was reduced to 6 ft. The usual hook gage was fastened to a bridge about 10 ft. from the crest of the weir. Later it was found necessary to lower the notch of the weir about 6 in.

Excess water was handled by a wasteway located in the forebay. The amount of water flowing over the wasteway was measured by checking the readings of hook gages at the wasteway flashboards and at the weir, there being practically no leakage through the wheels.

The output of the plant was measured by portable electrical instruments placed in the secondaries of instrument transformers, all being calibrated. In series with each of the two phases was placed a series transformer giving a ratio of 15 to 1. Transformers with a much smaller ratio would have been more satisfactory, but were not available. In the secondary of each transformer were placed an ammeter and the current coil of a wattmeter, short-circuiting plugs being provided so that the instruments were protected when not in use. Across each phase was connected the primary of a shunt transformer having a ratio of 20 to 1. The secondaries were connected to the potential coils of the wattmeter, care being taken to avoid putting the potential of one phase on the wattmeter taking current from the other phase. One 110-volt instrument and a double-throw switch enabled the voltage on each phase to be read. All connections were made behind the switchboard and the instruments were grounded so that the maximum potential from any instrument to ground was 110 volts.

The results of the tests are given in the above table.

| Run. | WATER USED, IN CU. FT. PER SECOND. | | INPUT TO WHEEL. | | Output of Generator, in Kilowatts. | Power-Factor. Per Cent. | EFFICIENCY. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Wheel. | Wasteway. | Horse-Power. | Revolutions per Minute. | | | Generator. Per Cent. | Wheel. Per Cent. | Plant. Per Cent. |
| 1 | 19.5 | 5.13 | 55.0 | 347 | 18.46 | 80.1 | 77.5 | 58.1 | 45.0 |
| 2 | 19.7 | 4.75 | 55.7 | 347 | 23.99 | 97.5 | 81.6 | 70.8 | 57.8 |
| 3 | 18.4 | 4.5 | 52.0 | 347 | 23.71 | 76.5 | 81.4 | 75.2 | 61.2 |
| 4 | 22.43 | 0.37 | 62.5 | 347 | 25.13 | 89.0 | 82.5 | 65.4 | 53.9 |
| 5 | 15.43 | 7.18 | 43.4 | 347 | 15.08 | 97.0 | 75.0 | 62.0 | 46.6 |
| 6 | 20.26 | 2.35 | 56.9 | 347 | 15.08 | 97.0 | 75.0 | 47.4 | 35.5 |
| 7 | 18.9 | 4.20 | 53.4 | 347 | 23.74 | 72.1 | 81.6 | 73.1 | 59.6 |
| 8 | 21.07 | 2.03 | 59.6 | 347 | 21.77 | 82.0 | 80.0 | 61.3 | 49.0 |
| 9 | 11.10 | 12.0 | 31.75 | 347 | No load gate | 0.3 opening. | | | |
| 10 | 11.6 | 5.88 | 33.02 | 347 | 7.39 | 100.0 | 60.0 | 50.0 | 30.0 |

# Central Station
## Management, Policies and Commercial Methods

### STICKERS TO CREATE SHOWROOM INTEREST.

The Public Service Electric Company of New Jersey has prepared several 4½-in. x 5-in. stickers reproducing in brilliant colors interior views of its Newark apparatus display-rooms, which are attached to customers' bills for the purpose of creating an interest in the company's appliance exhibit. The views reproduced include the main showroom, electric-lamp section, basement showroom and entrance doorway. The company's offices are handsomely fitted up in white marble with bronze fixtures and trimmings, and the illustrations by the four-color process make a striking appearance which serves to attract many customers to the central-station offices.

### CENTRAL-STATION KEY TAGS FOR REAL-ESTATE AGENTS.

A large Western central-station company has furnished each of seventeen local real-estate agents with 100 label tags for house-renting keys. One side of the tag is blank for the address, and the reverse bears the legend, "When you are ready for electric light and power, telephone ——— Electric Company, ———." The card presents a reminder to the newly settled householder, informing him whom to call up to have service turned on or his house wired. The real-estate men are much pleased with the tags, and the electric-service company's office was soon deluged with additional requests after the first lot was sent out.

### ELECTRIC-VEHICLE HANDBOOK.

The New York Edison Company has just issued for the benefit of electric-automobile charging customers and others interested a 130-page handbook on "The Electric Vehicle, Its Construction, Operation and Maintenance," prepared by Mr. Norman G. Meade. Following a chapter devoted to the general description of both pleasure and commercial cars, including discussions of transmissions, drives, motors, controller positions, etc., other sections contain instructions for the operation and maintenance of cars

and storage batteries, care of batteries, etc. Special chapters are given on the subject of charging batteries from direct-current and alternating-current sources. The final chapter on miscellaneous information includes specifications for various types of trucks, followed by a dictionary of terms used in electric-vehicle practice. The handbook is fully illustrated by more than fifty half-tone and line-cut reproductions, and, while intended primarily for prospective automobile customers of the central-station company, the material has been prepared so as to be of service to garage employees and those handling electric vehicles. The handbook is given out upon application to Mr. Harvey Robinson, manager of the New York Edison Company's automobile bureau.

## TUNGSTEN LAMPS ADVOCATED FOR RESIDENCES.

Opposition to the tungsten lamp for residence lighting on the part of central-station operators appears to be disappearing rapidly. In Chicago it no longer exists, if one is to judge by a recent newspaper advertisement of the Commonwealth Edison Company, which notifies its residence customers by this means that they can enjoy in their homes the brilliancy and economy afforded by the tungsten lamp. Attention is directed to a special tungsten outfit, comprising one lamp, either 40 watt or 60-watt in size, with pull-chain socket, shade holder and shade, sold for $2.40 for the combination. This amount may be paid in two monthly instalments. The title to this advertisement is "Double the Light in Your Home at No Greater Cost for Electricity."

## DO GAS ARCS "STAY PUT"?

One way of estimating the satisfaction given by a device is to compare the number installed with the number that "stay put." If the gas companies were less reticent about giving out the number of so-called "gas arcs" taken out at the end of the trial period, these data would be of value to electric-light solicitors. However, the gas people are usually silent on this point in their open meetings, although occasionally a pertinent reference to the questionable satisfaction given by the gas arcs creeps even into their public sessions. Thus at the recent annual meeting of the Pennsylvania Gas Association Mr. J. V. Bout, of Williamsport, Pa., gave this advice to his fellow members in a formal paper:

"When replacing electric lamps with gas arcs it is advisable that the electric equipments be removed. This should be suggested, as they are no longer required, gas being perfectly reliable at all times. The place of business will have a much better appearance without them, and, in case the merchant is a man who finds it difficult to remain of the same opinion for any length of time, your suggestion may relieve him of this difficulty."

In other words, the method recommended for making a customer retain the "gas arcs" when once installed is to rip out the electric wiring so that he cannot go back to electricity if he concludes that he has been unfairly talked out of using it. Following this line of reasoning, a glib salesman offering kerosene or gasoline lamps shall ask his prospective customers to tear out both gas pipes and electric wires so that no victim can readily return to the superior illuminant when he finds out the really high cost of poor lighting.

Judging from the growing breadth and shrewdness of the merchants to whom such a proposition would have to be made, it seems hardly credible that any considerable number of them would be led to abandon their ready access to electric lighting and incidentally to the use of fan motors which may be needed all the more when the gas arcs begin to radiate their heat. However, the fact that such a recommendation is made in a formal gas association paper shows to what extremes some gas advocates feel that they must go if they want their lamps to "stay put."

## ENERGY CONSUMPTION OF CUSTOMERS' REFRIGERATING PLANTS.

Some figures on the quantity of energy consumed during the year by several customers' motor-driven refrigerating installations in Canton, Ohio, were given by Mr. W. C. Anderson, manager for the Canton Electric Company, before the Ohio Electric Light Association, July 26.

Of the ten such installations now in operation in Canton several have been in use for eight or nine years, and all have been operated with entire satisfaction to their owners. Below is given the consumption, in kw-hours, of each of the six of these plants which are so metered as to give results available for comparison.

ENERGY CONSUMPTION OF REFRIGERATOR INSTALLATION.

| Tons refrigeration<br>Motor horse-power | 3<br>7½ | 3<br>10 | 5<br>20 | 3<br>7½ | 5<br>26 | 3<br>16 |
|---|---|---|---|---|---|---|
| January | 146 | 646 | 1,950 | ... | 51 | 516 |
| February | 70 | 733 | 2,210 | ... | 34 | 120 |
| March | 112 | 846 | 2,070 | 286 | 102 | 892 |
| April | 322 | 1,627 | 2,600 | 1,528 | 1,240 | 2,168 |
| May | 247 | 1,654 | 2,850 | 1,622 | 1,139 | 1,928 |
| June | 403 | 2,826 | 3,600 | 2,050 | 1,069 | 1,976 |
| July | 343 | 4,718 | 6,040 | 2,062 | 2,649 | 1,978 |
| August | 540 | 5,633 | 5,590 | 2,060 | 2,518 | 2,212 |
| September | 591 | 4,174 | 4,790 | 1,712 | 2,100 | 2,200 |
| October | 576 | 2,145 | 4,200 | 1,476 | 1,639 | 2,052 |
| November | 453 | 1,161 | 2,630 | 804 | 944 | 1,540 |
| December | 335 | 229 | 3,310 | ... | 936 | 264 |

During the discussion Mr. W. S. Culver, of Schenectady, N. Y., spoke of the attention given to combination ice-making by the technical press, citing articles that have recently appeared in the *Electrical World*. He also announced progress work on a refrigerating system, chemical in nature, which is being brought out for the use of individual families, and which will employ a small motor of ⅛-hp to 3-hp rating, running continuously throughout the twenty-four hours.

## HEATING-APPLIANCE CAMPAIGN METHODS IN OHIO CITIES.

A town of 2000 population in Ohio rents electric irons to customers at the cost of 5 cents per week, which amount is included in the monthly bill, according to Mr. P. L. Miles, of the Cleveland Electric Illuminating Company, who reported on the introduction of electric heating devices in a paper read before the Ohio Electric Light Association at Cedar Point July 28. About 100 customers in the little town are now using electric irons, eighty of whom rent their irons from the company at this rate.

In a city of 80,000, said Mr. Miles, the company supplemented its extensive advertising campaign on heating appliances by sending out a wagon to make a house-to-house canvass. A young lady demonstrator was also installed in the electric company's office, among her duties being to telephone prospective appliance users on washdays suggesting that an electric flatiron be sent out to the home for trial. These days were considered the psychological time to tell about the comfort and convenience of the electric iron, and several hundred irons were sold as a result of the campaign.

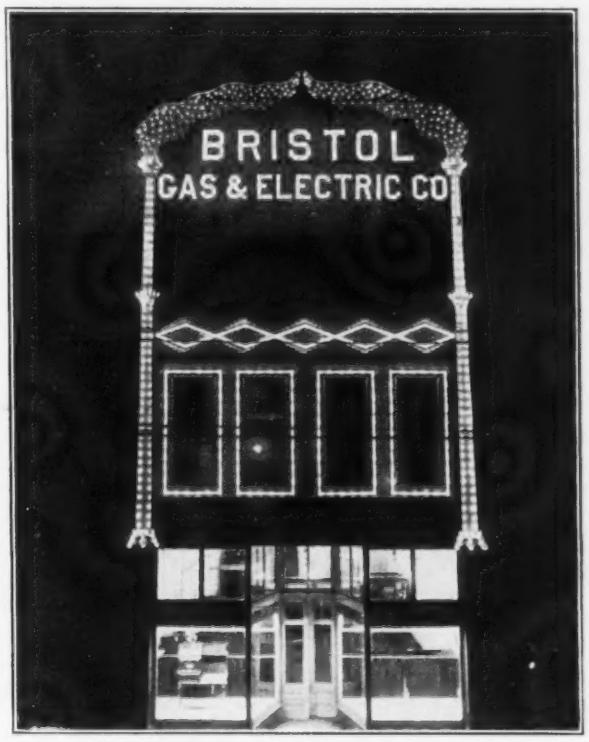
The company in another city of 120,000 has now ceased its efforts to advertise electric heating appliances, believing that its community is fully saturated. For some time past this company had a display-room which proved suc-

cessful. This room was also supplemented by an intensive advertising campaign with satisfactory results. Now, however, that these utensils have been thoroughly introduced to the public, and they have been informed through the educative advertising campaigns of the many advantages of this class of heating utensils, the company has turned the sale over to the local dealers, closing the display-room and for the present stopping its advertising along these lines.

In another city of 50,000 the contractors give an electric iron as a premium to the owner of each newly wired house, said Mr. Miles, thus "killing two birds with one stone and securing both a lighting and a heating load."

## ILLUMINATION OF CENTRAL-STATION OFFICE FRONT.

The Bristol Gas & Electric Company, Bristol, Tenn., has just opened a new and elaborate office and salesroom, the front of which is shown in the accompanying illustration.




Illuminated Front of Central-Station Office.

The design contains 1500 lamps, 300 red, 300 green and 900 white. The top of the sign represents an immense flame with red lights twinkling. The zigzag across the front of the building is in white lamps with a chasing effect, while the pilasters are green, making a very artistic effect. The sign front was built at a cost of $900.

## COLORADO ELECTRIC SHOW.

The second annual electric show of the Colorado Electric Club will be held in the Denver Auditorium Oct. 14 to Oct. 21, inclusive. The financial management will be on a plan somewhat different from former ones. The stock company which was formed and which figured in the distribution of the earnings of the first electric show has been dissolved. The Colorado Electric Club, which has since become a corporate body under the laws of the State, will be in complete charge of the exhibition and the profits will be divided in a co-operative manner, the Electric Club and the exhibitors receiving equal shares. It is planned to feature Colorado's resources on a much more extensive scale this year than last, and for this reason all mining-machinery exhibits will be located in the basement of the Auditorium. Numerous underground tunnels and subways depicting the interior workings of a mine will be attempted in order to show mining men visiting the show the advantages of electric drive. Another feature which will be exploited will be the exhibition of electrically operated farm machinery, and the generating and transmission companies throughout the State are planning an elaborate display to demonstrate the possibilities of the electric pump. A miniature farm plot will be constructed in the basement of the Auditorium for this purpose. The street-lighting effects of the last show will be reproduced at the coming show on a more lavish scale, but the interior decoration and illumination of the Auditorium will be much the same as last year, with the exception that the large electrical curtain portraying the Pike's Peak sunset will be displaced by a dancing vaudeville girl. This effect will require the use of some 1200 lamps. The booth arrangement will be the same as last year. Much is promised in the way of entertainment. The freakish whims of high-frequency currents will be repeated with innovations under the supervision of Mr. J. F. Reardon. Mr. Clare N. Stannard, chairman of the entertainment committee, has several unique schemes under consideration, announcement of which has been deferred until a later date. The Sons of Jove will hold a convention during the week of the show and many special features will be arranged for the visiting Jovian delegates on one night which will be set apart for their benefit. The following board of directors will be in charge of the exhibition: Mr. W. P. Carstarphen, Jr., president; Mr. H. L. Wolfenden, vice-president; Mr. W. F. Brown, second vice-president; Mr. C. F. Oehlman, secretary-treasurer, and Messrs. W. G. Matthews, Clare N. Stannard, B. S. Manuel, J. F. Dostal, Irving Hale, F. F. Greenawalt and J. F. Reardon.

## SAPULPA'S ELECTRIC-LIGHT WELCOME.

Sapulpa, Okla., is in the center of one of the greatest oil fields in the world, 8000 wells being in operation within a radius of 7 miles of the city hall. The little city is also a junction point and division headquarters of the "Frisco" Railroad, and many through trains are stopped there for

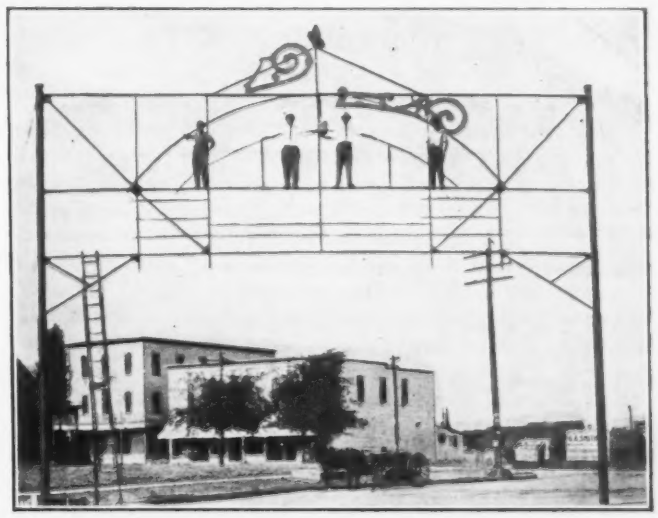


Fig. 1—Sign Under Erection.

waits of from twenty minutes to one hour. To advertise the community to the thousands of passengers who traverse this trunk line to the Southwest, the Sapulpa Electric Company has just erected and presented to the city the hand-

some spectacular sign illustrated herewith, bearing the words, "Sapulpa, the Oil City of the Southwest." The sign is on one of the principal avenues of the town, opposite the station, where trains meet from three directions. The display comprises 1000 5-watt tungsten lamps and is

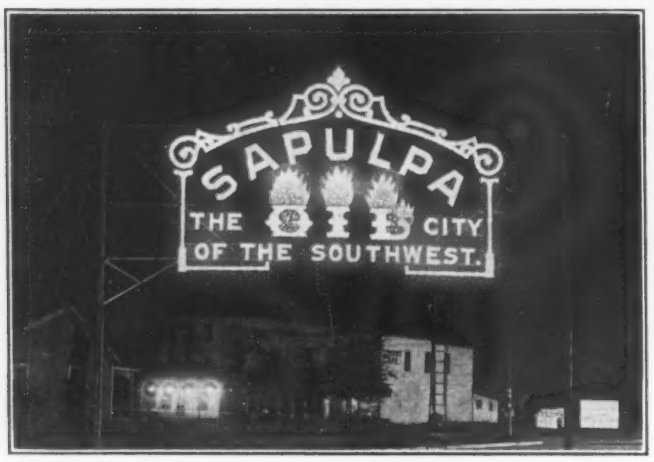



Fig. 2—Sapulpa's Electric Sign at Night.

erected on two iron poles with angle-iron framework carrying the sign proper.

The operation of the sign is as follows: The fancy scroll border is first flashed on in green, followed by the word "Sapulpa" in 3-ft. letters. Then appear the lines "The Oil City of the Southwest." After all letters on the sign are burning the "flames" on the word "O-i-l" flash on with a twisting, irregular burning effect, giving an excellent representation of the flaming of an oil torch.

The cost of operating the sign is $75 per month, or $2.50 a day, and the sign gives publicity to the town and draws forth favorable comment which could not be obtained in any other manner for several times the cost.

The Sapulpa Electric Company has received the warmest appreciation from citizens and city officials for the progressiveness and "booster" spirit indicated by the installation of this sign. A ten-year contract with the city for the operation of this sign was recently obtained by Mr. A. Larney, new-business manager for the Oklahoma Gas & Electric Company, which, like the Sapulpa company, is under the management of H. M. Byllesby & Company, Chicago.

## CONTINUOUSLY CONNECTED ELECTRIC RANGES IN CLEVELAND.

Thirty-two of the continuously connected electric ranges employing the fireless-cooker principle (described in the *Electrical World* of April 27, 1911) are now in use on the lines of the Cleveland Electric Illuminating Company, the thirty-third being retained in the offices of the company for demonstration purposes. Fifteen other generally similar ranges, but having an improved positioning of the oven and heater parts, are now ready for delivery to Cleveland, where they will be put into domestic service in customers' premises.

The feature of these Cleveland ranges of special central-station interest is the twenty-four hour continuously connected 150-watt heating elements inclosed in the thermally insulated oven, which is thus maintained at a temperature of 400 deg. Fahr. and suffices for all cooking operations except frying and broiling. For the latter a 1500-watt radiant-type heating element is also provided inside the oven, and for frying two 400-watt and two 1600-watt disk heaters are arranged on the shelf. These heating units are controlled from push switches, high and low heats being indicated by switchboard-type target lamps. The radiant broiling unit is automatically cut off when the oven door is shut. The 150-watt heating element, inclosed in its heavy iron casting, is permanently connected across the service mains so that it takes 150 watts continuously and cannot be interrupted except by unscrewing the fuse plugs.

In the fifteen newly improved ranges for the Cleveland company the convenience of the housewife has been better served by mounting the oven at the side of instead of below the shelf carrying the heater disks, bringing all parts of the range at a comfortable height above the floor. In other respects these ranges are generally similar to the original thirty-three.

A very complete series of tests carried out on ranges of the above types in actual domestic service have revealed the high load-factor obtained through the combination of the continuously connected unit with the short-demand heaters. Curves summing up the total consumption equivalent to 160 days' use of one range for family cooking show an average demand equal to about one-third of the maximum recorded peak of demand, indicating an eight-hour load-factor for the range. The total consumption shown by these Cleveland ranges for equivalent service, however, slightly exceeds that of the ordinary high-demand short-hour ranges on the market, which have, of course, very low load-factors. The high load-factor of the Cleveland stove would entitle it, therefore, to a lower rate from a central-station standpoint than the short-demand ranges, but for the thirty-two stoves on its lines the Cleveland Electric Illuminating Company charges the same rate of 5 cents per kw-hour, collecting an average bill of $10 a month from customers having these stoves in use in their kitchens.

Not content with achieving a 33 per cent load-factor range, Mr. M. E. Turner, contract agent for the Cleveland company, to whom the idea and practical application of the continuously connected heater are due, now has nearly ready for trial operation in his city a dozen other ranges having a 100 per cent load-factor of their 500-watt demand. Unlike the former Cleveland stoves above mentioned, these new unity load-factor ranges have no other heat elements except the 500-watt heater, which, continuously connected, provides heat for baking, roasting, frying and all other cooking operations. If desired, a 300-watt

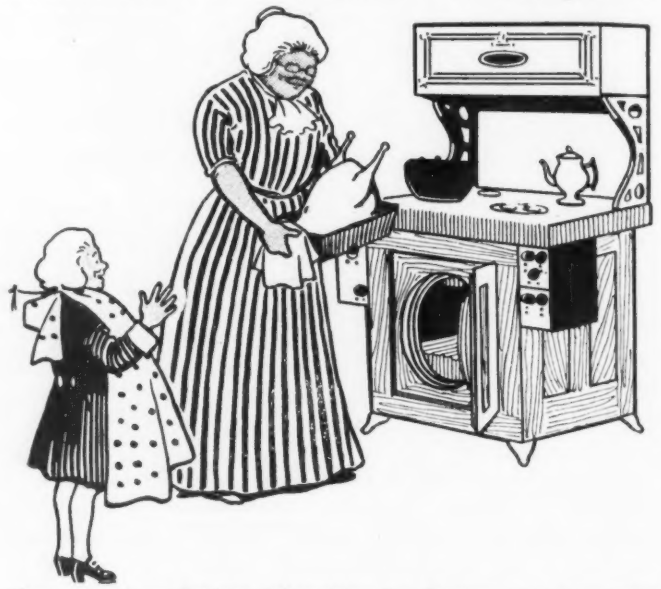


Illustration from Booklet Advertising the Continuously Connected Electric Range.

continuously connected water heater may be provided as part of the range at the option of the purchaser. Such a range, taking energy twenty-four hours a day, will enable the central station, it is expected, to fix special rates for long-hour service, lowering the cost of electric cooking to

a point not desirable with the mixture of continuous and short-hour demand of the earlier stoves.

Besides its present thirty-three continuously connected ranges the Cleveland company has on its lines about seventy of the ordinary intermittent-type ranges.

The domestic advantages of the fireless electric cooker are attractively set forth in a booklet issued by the company. The following quotation is taken from the opening paragraphs: "In the summer months it almost comes to a question of deciding whether the family shall have warm, well-cooked meals, and the housewife or cook suffer with prostration from bending over a hot stove, or whether she shall give the family cold victuals and have them all suffering with indigestion.

"The new electric oven solves this problem completely. Its heat remains inside. You can have bread baking in the oven and a brick of cream on top of the oven without affecting the latter's solidity in the least. * * * There is no waste of heat—no radiation from the stove to make the kitchen hot or unhealthful."

## DISTRICT OFFICE OF THE BOSTON EDISON COMPANY.

The Newton-Watertown district office of the Edison Electric Illuminating Company of Boston is one of the attrac-

Fig. 1—Exterior View of the Newton-Watertown District Office.

tive district headquarters of that company. It is located in Nonantum Square, Newton, Mass., in about the center of

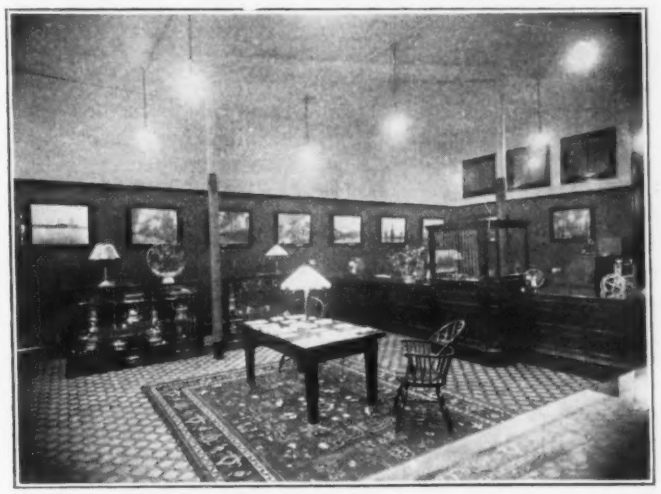


Fig. 2—Interior View of the Newton-Watertown District Office.

the district with reference to population. The district, which embraces the city of Newton and the town of Watertown, contains a population of 52,681 and has an area of 22 1/10 square miles.

The number of customers served in the district is approximately 2500. There are 80,000 50-watt equivalents in lamps and about 500 motors with an aggregate of about 3000 hp connected.

The office is attractively decorated with prints of the company's central power plant and several substations and is lighted from drop lights and some attractive shaded table lamps. Customers use the office as a place to pay bills and exchange lamps, which the company does without charge.

# Wiring and Illumination

## FOREIGN STREET-LIGHTING DATA.

In a series of four articles appearing in recent issues of the London *Electrical Review*, Mr. L. Crouch presented a general review of the subject of street lighting which contained numerous interesting data. Table I contains a summary of illumination values recommended by various authorities for London, Paris and Berlin streets. The ratio of maximum to the minimum illumination falls as low as 5 in certain of the main Berlin streets where flame-arc lamps of the latest type are used. This remarkably uni-

TABLE I.—AVERAGE ILLUMINATION ALLOWANCES IN LONDON, PARIS AND BERLIN.

| | Minimum. | Maximum. | Mean. |
|---|---|---|---|
| | Foot-candle. | Foot-candle. | Foot-candle. |
| Smallest side streets. | 0.0085 | 0.85—1.28 | 0.13—0.26 or 0.34 |
| Fairly busy streets. | 0.128 | 4.25 | 0.425—0.85 |
| Main streets..... | 0.170—0.255 | 8.5—12.8 | 1.70 |

TABLE II.—APPROXIMATE PRESENT USE OF VARIOUS LAMPS IN STREET LIGHTING IN THE UNITED KINGDOM.

| Incandescent Lamps. | | Arc Lamps. | |
|---|---|---|---|
| *Carbon Filament.* | | *Inclosed.* | |
| 16 cp and under..... | 3,000 | 5 amp to 7 amp..... | 1,000 |
| 25 cp to 50 cp, inclusive.... | 1,700 | Miscellaneous ..... | 2,400 |
| Miscellaneous ..... | 3,600 | *Open.* | |
| *Nernst.* | | 5 amp to 7 amp..... | 720 |
| 0.5 amp..... | 980 | 7 amp to 10 amp..... | 6,400 |
| 1 amp..... | 150 | 12 amp to 15 amp..... | 1,150 |
| Miscellaneous ..... | 570 | Miscellaneous ..... | 3,400 |
| *Metallic Filament.* | | *Flame.* | |
| 16 cp..... | 1,300 | 8 amp to 10 amp..... | 1,500 |
| 25 cp to 50 cp, inclusive.....10,900 | | Miscellaneous ..... | 2,200 |
| 100 cp..... | 2,500 | Mixed arc lamps..... | 8,500 |
| 200 cp to 1,000 cp..... | 400 | | |
| Miscellaneous .....37,000 | | | |
| Carbon and metallic filaments mixed .....12.900 | | | |

TABLE III.—PERCENTAGE VALUE OF VARIOUS ANNUAL CHARGES.

| Type of Lamp. | Percentage Value of— | | | |
|---|---|---|---|---|
| | Capital Charges. | Energy. | Renewals. | Attendance. |
| Ordinary arc..... | 6.0 | 81.8 | 3.6 | 8.6 |
| Flame arc..... | 10.8 | 50.6 | 23.2 | 15.4 |
| Metallic filament..... | 7.1 | 79.6 | 11.7 | 1.6 |
| Carbon filament..... | 9.7 | 82.3 | 5.7 | 2.3 |

form illumination is attained by the use of high candle-power units mounted at great height. In Table II is given an approximate estimate of the number of lamps of various kinds used for street lighting throughout the United Kingdom. In Table III are shown relative values for interest on investment, cost of energy, renewals and attendance for various types of lamps under London conditions.

## ECONOMICAL INTERIOR WIRING CONSTRUCTION.

By W. J. Canada.

The electrical interests of this country, through a gradual growth in exchange of convictions and in resultant harmony between service company, wiring contractor, manufacturer and underwriter, have evolved interior wiring methods and material which would seem to be almost foolproof, and whose initial cost is warranted only by a proved long life and low maintenance expense. Service companies in the past have too frequently looked at the immediate cost and have not seen the permanency and safety thereby secured. They have been the conservative influences resisting innovations in city and underwriters' requirements for extra mechanical protection and better insulation, just as underwriters have been the conservatives where devices of questionable safety were concerned.

To-day conduit protection for wires, cabinets for cut-outs, restricted use of flexible cords and like minimizing of experienced frailities and fire hazards have given electricity the public confidence and have vindicated themselves as the best possible wiring methods with known materials. The underwriters can suggest no greater measure of safety and the service company wishes no less permanent vehicles for safe transformation of its product to the purchasers' use. Some attempts to introduce here methods which have proved satisfactory in the countries of Europe meet with the same obstacle in the way of reduced personal responsibility which is at the root of our national fire waste, our impressive yearly industrial death roll and our other tributes as a nation to a mistaken application of the personal liberty idea.

But with the completion of a conduit system, fuses, switches, wire insulation, all protected cord eliminated, and chances for overheating or harmful arcs apparently gone, the inspector releases the masterpiece of safety to the spirit of carelessness that pervades us. The owner is occasionally thoughtful, but is then at the mercy of his wiring contractor and his various tenants and, most of all, subject to the irresponsibility and petty vanity of tenants themselves or of their employees. A year's changes in this reliable, safe installation will introduce many hazards; five years will necessitate expensive changes to restore the original condition. This being the case with modern installations, it is small wonder that wiring of an earlier day and open wiring as even now installed, with open fuses, cords within reach and unarmored wire insulation, invite defective additions and changes most enticingly and effectually. Thus some of the most rapid depreciation of open wiring systems may be accounted for.

It has become increasingly apparent that only a financial depression of absolutely unprecedented severity and continuance can possibly so change the mental attitude of our citizenship as a whole as to introduce the European standards of painstaking and of law observance, of abhorrence for the continual expense of frail construction and of fear for the greatest destroyer of material wealth—fire. The German seems to appreciate that material wealth is the product of the community and for the ultimate benefit of the people and accepts fully the conviction among thinking men that no individual has a moral right to destroy this beneficial wealth. Our citizenship misconstrues individual liberty into license from any interference by law with carelessness which must and does result in frailty and fire loss, and which to the supposedly less advanced European would seem criminal. Our fire devastations in the last ten years would have bankrupted any other nation, and yet 90 per cent of our population never pause to consider the cause of this effect, in carelessness, first by poor construction laws, then by poor law observation and finally by lack of personal responsibility in maintenance.

Educational methods involving the broadest publicity and utilization of the most popular appeals have been adopted by underwriters and service companies, and some impression is apparent on the public mind. The slow growth in a public acceptance of restraint is, however, a most evident fact. No attempt has ever been made to secure restrictive legislation by our federal government for interior wiring and its subsequent maintenance. Few of our States have ever passed any statutes on the subject. Fortunately, our municipalities are awaking to their responsibilities and, though much involved still with politics and frequent incompetency, our municipal restrictions are the present stronghold of the defense of community welfare against the aggressions of individual license, in the name of initial cheapness, upon easily maintained and permanently safe building construction.

The matter first to be considered by the municipality has been the character of construction to establish as a standard. The National Electrical Code is the product of early and continued co-operation in the early days of electricity between the various electrical and insurance interests, and has been so well guided as to be to-day the most widely accepted material standard in the world and the code of specifications most widely incorporated into ordinances. Its detractors daily are fewer, their criticisms of less moment. Its faults are eliminated as rapidly as practice demonstrates a need.

The electrical problem most sharply confronting underwriters and municipalities to-day is the maintenance of initially good conditions by prohibition of changes which introduce weaknesses. On a par with this problem is the related one of restoring to a permanently safe condition those older wiring installations in which originally frail material and methods have rapidly succumbed to the deterioration of time and the depredations of unauthorized or irresponsible workmen. Of these problems the latter belongs essentially to the underwriters, by whom it is being conservatively solved by publicity methods, personal presentation to owners, and finally by adjusting insurance taxes so that a greater proportion is contributed by those owners maintaining larger electrical fire hazards.

The former problem is being to some extent attacked in our more progressive cities by adoption of annual reinspections, which not only secure physical rehabilitation but also induce personal interest by owners and tenants in their respective avoidance of future expenditures of this nature. A rigid yearly inspection may readily be changed after a few years to one at longer intervals, as education of the wiring public will be rapid.

The suppression of further wiring without metal protection or runways is a first requisite of reduced maintenance cost and safety. This has been done by ordinance in advanced cities, but is still lacking in most of our communities. Other forms of wiring entail probable injury to wires and interference with them. Their certain deterioration must ultimately bring about lack of safety and the end of their economic life. The uninformed owner of property, rarely the one who paid for the original installation, sees in an enforced renewal an unforeseen duplication, an injury to decorations and a poor relation of electric wiring permanency to that of other portions of his building. The rewiring may be necessitated by serious overloading, by contacts, crosses, broken insulation, the result of mechanical interference, or may be mere deterioration. On the principle, however, that we rarely abandon articles even when uneconomical to use, the wiring is changed usually at the instance of the underwriters, or sometimes of particularly efficient municipal inspectors, and the indefinite grievance of the owner is directed at them.

Until underwriters and municipalities restrict their recognition of any other than metal-protected wiring entirely to dwellings in residence districts, they will be under suspicion of much shortsightedness if not lack of good faith. An approval of open or concealed knot and tube work, only to be condemned or charged for in insurance ratings a few years

after approval (the exact time before necessity for condemnation arises depending only on the character of building construction and occupancy), rightly lays the authority first recommending such construction under strong disapproval of a hastily judging public. An attitude of reluctance in approval of such wiring or, better yet, an active general campaign for conduit and related construction, together with personal conference with building owners and written recommendations to that end, will justly place the underwriter in a position of vantage in the few cases where diplomacy and persistence still fail to bring about the adoption of the permanent construction. The municipality which has reached the point of adopting restrictions should rapidly arrive at a point where consideration of future welfare is effective enough to produce a conduit requirement for new and rewiring.

Quite recently in Colorado Springs, Col., a bitter if futile attack was made upon one of the best considered and most conservative electrical ordinances in the country, containing the conduit provision throughout fire limits and for assembling occupancies within city limits, bringing up as argument that underwriters made no extra charge where frailer forms of construction were employed. The city electrician simply stated that the city should certainly stand for permanent safety if underwriters did not and that in his opinion the time would shortly come when underwriters would distinguish in rate between enduring and frail types of wiring and avoid the subsequent ill feeling produced by later condemnations of the latter construction after it has suffered the vicissitudes to which it is by nature subject.

In spite of the possible ultra-conservatism of underwriters toward abandonment of early standards, except where proved initially hazardous, their growing championship of conduit ordinances and emphasis on its ultimate insurance benefits seem to herald their recognition of its lower measure of fire hazard. The more progressive service companies are equally desirous of avoiding any suspicion of comparative frailty in wiring and strongly back the conduit movement.

Upon reinspection work the municipality should enter with thoroughness and require the corrected installation to eliminate all temporary features of every kind. An exhaustive treatment in the first reinspections will obviate necessity for great frequency of following ones. The use of flexible cord instead of permanent construction for additional lamps, the use of pendants and even lack of guards where stock is handled at or above the lamp level, the use of paper lamp shades, the overloading of circuits and feeders by additional lamps, motors or heaters, the installation of home-made time switches, displays, etc., all are common abuses of even the best installed wiring systems, and of course are more numerous, because more easily attached, in the less protected forms of wiring. The above faults are so common as to seem to many concerned in energy supply and even in wiring inspection to be inherent to the interior applications of electrical energy. Too often inspections of large new additions or changes in the building wiring are made perhaps conscientiously but with absolute disregard for the growing defects of the original system.

This attitude is responsible for the respectable list of fires and fire loss and the unsatisfactory service which still is attributable to modern wiring and which many times furnishes excuse if not reason for unpleasant citations by sellers of other illuminants. The attitude is due to an undirected interest rather than lack of interest and partially to the unfortunate system so generally adopted by our cities which fosters the concentration of effort by municipal inspection departments too largely on income increase as against actually greater returns to the municipality in more easily maintained wiring and reduced fire losses.

Recently in a Western city a manufacturer of gasoline lighting systems leased one of two exactly similar buildings, erected adjoining, equipping his building with a hollow-wire gasoline system. The other building possessed a conduit-wiring system. The gasoline arrangements subjected the one building to extra insurance charges. Within the year a small fire occurred through the abrasion of insulation on a flexible cord in contact with stock in the electrically illuminated building. An easily avoidable and non-inherent wiring defect thus became responsible for many harmful comparisons.

In a majority of cities the only check on abuse or defective additions to standard wiring is the very irregular reinspection of buildings by underwriters to report on changed conditions of occupancy. Even then it is often inadvisable to apply insurance charges for minor defects, and the owners or occupants will consider the lack of charge to offset the recommendations of underwriters for re-standardization.

The problem is essentially for the municipality and is being gradually so recognized and worked out in our better regulated cities. When by educative processes our municipalities come to require initial conduit construction and enforce its proper maintenance a degree of permanence and safety will be given interior wiring which will add to the convenience, variety and attractiveness of electrical applications that sustained cheapness which has up to this time delayed their more general adoption. We will have our entire urban population customers instead of the present 20 per cent to 60 per cent, and the amount per capita now spent on rewirings and electrical fire losses will be diverted to investment in new applications of electricity and to the replacement of other illuminants. For this result we require a more aggressive co-operation of electrical interests toward permanent construction, the elimination of frail appendages wherever possible and, most of all, the development of the reinspection idea and its general rigid adoption throughout the country. In the early accomplishment of this result electrical engineers and organizations will be doing good pioneer work for the conservation of our created material wealth.

## RECENT TELEPHONE PATENTS.

### UNIVERSAL CORD CIRCUIT.

When magneto and common-battery lines are terminated upon the same switchboard position the connecting-cord circuit must usually be arranged so as to be operable with either class of lines to which it is to be connected. Such a condition similarly exists where toll lines and common-battery exchange lines are to be interconnected. The adjustment of the cord circuit is sometimes accomplished by manually operated keys, the operator being trusted to switch for any particular condition of the connection. In other cases the switching is made automatic by arranging relays to perform the circuit changes. To accomplish this the relays respond or remain stationary according to the line jack to which the cord pair is plugged.

Since each of these systems has points of superiority not possessed by the other, the two methods can be combined to advantage to meet all conditions, as has been done by Mr. E. D. Hall, of New York City. He arranges a manual key to make certain alternative conditions and supplements this with a relay which performs its function irrespective of the position of the manual key. Mr. Hall has obtained a patent for his circuit, which he has assigned to the Western Electric Company.

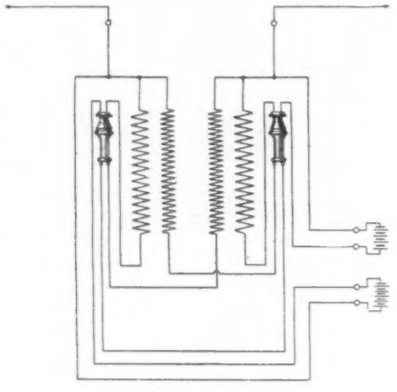
### PHANTOM-CIRCUIT SYSTEM.

A phantom circuit is obtained by so associating repeating or retardation coils with each of two-wire or physical circuits that a third non-interfering circuit is formed. In order to accomplish this effect a neutral point must be founded for each physical circuit to which the terminal of the phantom is attached. The establishment of this neu-

tral forms part of the novelty of the present system, which has been patented by Mr. H. O. Rugh and is assigned to the Sandwich Electric Company. He makes a bridge across the physical circuit near its end, this bridge consisting of a condenser, two exactly similar retardation coils and a second condenser. The link between the coils is chosen as the neutral point, being brought to this condition by making the condensers adjustable. A further feature is the signaling system. A bell is arranged with its circuit held open by a continuously energized relay. This relay has its circuit carried through both the front and back contacts of a second relay, the winding of which is in turn connected with the phantom. An intermittent current on the phantom causes a vibration of the armature of the connected relay, the armature of which releases the bell-control relay. This closes the bell circuit to signal the phantom station.

#### REPEATER CIRCUIT.

In the accompanying illustration there is shown a repeater circuit, the invention of Mr. W. Anderson, of Longdale, Okla. From the sketch it will be seen that the repeater is of the telephone-microphone type and that the two elements are so connected to the circuit as to be in series, the idea being to have the incoming and reinforcing currents in unison.



Telephone Repeater.

#### PARTY-LINE SET.

With multi-party circuits, such as rural lines, the battery is frequently quickly run down uselessly because of "listening-in" on the line. To obviate this Mr. R. C. Smith, of Homer, Mich., has patented a set in which the hook switch does not close the local-battery circuit. This must be separately closed by a push switch which locks in the closed position. When the receiver is restored to the hook the push switch is then automatically released.

#### BELL-LESS SIGNALING SYSTEM.

Mr. G. C. Cummings, of Western Springs, Ill., is the patentee of a signaling system with which no bells are required. The hook switch is so arranged that the receiver is left in circuit when the hook is depressed. A vibratory current of high frequency sent out upon the line will cause the receiver to sing and thus attract attention.

#### DEVICES FOR IMPROVING TRANSMISSION.

When telephone lines are loaded with distributed inductance to improve the transmitting efficiency the insulation must be kept high or the leakage will not only destroy the effect of the coils in bettering transmission, but the coils become a drag on the circuit. Considerable effort is being made to hold up the insulation of loaded lines under all weather conditions. Mr. L. W. Carroll, of Anamosa, Ia., has approached the subject from a negative direction. Instead of holding up the line insulation he has devised a coil shunt the resistance of which is subject to the weather. The arrangement consists of an insulating carrier with a double thread upon its surface. Each thread carries a helix of bare wire, one being attached to each coil terminal. As the line leakage increases so does that between the helices, thus shunting the load coil.

Mr. J. A. Cuntz, of Hoboken, N. J., has designed and patented a new form of loaded circuit. He includes in his cable a magnetic core about which the conductors of each pair are wound in opposite directions.

#### MISCELLANEOUS SYSTEM AND APPARATUS.

A signaling apparatus forms the subject of a patent granted to Mr. A. J. Dunton, of Ketchikan, Alaska. The telephone set is so arranged that the receiver faces and hangs just clear of the transmitter. When the distant station calls a relay operates to connect the battery circuit through the receiver and transmitter, whereupon they mutually respond and set up a "howl."

A return to first principles is evidently favored by Messrs. J. B. Stemm, of Chicago, and G. E. Slade, of Brookfield, Mo., as they have patented jointly a telephone system using magneto transmission, one instrument serving as transmitter and receiver. The coils of this instrument are stationary, but the core, which is a small horseshoe magnet, is secured to the diaphragm, one leg projecting within a separate bobbin within which it is able to move without obstruction.

A combined desk set and desk lamp is patented by Mr. F. J. Kerbel, of New York City. The electric lamps and transmitter are within a dome shade at the top of the standard, the transmitter well up to the apex. A hook switch with receiver is mounted at the usual height from the base of the instrument.

Mr. I. F. Manny, of Milwaukee, is the inventor of a step-by-step selective system, the patent for which is assigned to the Selective Signal Company. An escapement controlled by current impulses permits a rotation of the selective apparatus to select the desired station.

Mr. Otto Schmid, of Heilbron, Germany, has combined with a telephone set an apparatus similar to our duplicate sale-slip register. The hook switch of the telephone is locked until the paper in the register is advanced. Everyone is told to record his call. The next user must advance the paper to unlock the switch. Blank paper indicates personal calls. The length indicates how many such calls have been made.

## Letters to the Editor.

### Stream Flow and Forestry.

*To the Editor of the Electrical World:*

Sir:—The writer, in his *Bulletin* on "The Flow of Streams and the Factors That Control It, with Special Reference to Wisconsin Conditions," which is the subject of editorial comment in your issue of July 15, has not endeavored to prove that deforestation has had no effect on the flow of streams. It is a popular superstition that deforestation has a radical effect on stream flow, and the writer has endeavored to ascertain if such effects are manifest in the flow of Wisconsin streams. He has stated (see page 84), "If deforestation has the effect claimed for it, such effect must be manifest within the period discussed (thirty to forty years), otherwise we can but conclude the effects of deforestation . . . are insignificant and unworthy of consideration."

The editorial comment on the apparent effect of deforestation on the flow of the Wisconsin River is incomplete and, therefore, misleading. In your discussion of the high-water and low-water periods on this river you have selected about the only period that would illustrate your point in regard to the possible effect of deforestation on high water,

and have ignored the question of rainfall, the manifest cause of all stream flow, which is certainly a most important element in the problem. Averages at the best are of little value, for it is only by careful consideration of the details of the problem that the probable cause of observed results can be determined. If there had been added to your published data a statement of the rainfall for each period you would have little reason to attribute the low water of the second fifteen-year period to deforestation; and if you had compared the first and second sixteen-year periods, your suggestion as to the possible effects of forests on floods would have been reversed.

As deforestation is still in progress in Wisconsin, and to as great an extent as at the beginning of the period considered, there seems to be no reason why the entire period should not be considered. In the accompanying table the writer has shown the days of flood (gage over 10 ft.) and of low water (gage under 2 ft.) for various periods within the record, in order to show how the selection of the period may modify conclusions. He has in each case also added the total rainfall for each period, from which it is seen that in each of the earlier periods the rainfall was almost 20 per cent greater than in the later periods. This exceedingly low rainfall is a logical reason for low-water conditions that does not require the addition of deforestation as a further explanation.

The direct relation between the progressive means of annual rainfall, mean gage height and extreme low water, as shown by Fig. 68 of the *Bulletin*, and the direct cause of

| Periods. | TOTAL DAYS. | | Total Inches Rainfall. | Excess, Per Cent. |
|---|---|---|---|---|
| | Above 10 feet. | Below 2 feet. | | |
| First 15 years | 28 | 4 | 550.38 | 24 |
| Second 15 years | 69 | 299 | 443.25 | |
| First 16 years | 62 | 4 | 582.65 | 20 |
| Second 16 years | 46 | 300 | 480.58 | |
| First 17 years | 62 | 72 | 610.23 | 17½ |
| Second 17 years | 67 | 232 | 518.96 | |
| First 19 years | 74 | 95 | 673.94 | 21½ |
| Second 19 years | 58 | 307 | 562.15 | |

extreme floods due largely to rainfall distribution, as shown by Fig. 50, makes the detailed relations manifest and warrants the writer's conclusions "that while theoretically forests will decrease the amount of precipitation reaching the earth's surface, thus decreasing the water supply of streams, and under certain circumstances may afford a limited storage which may aid in the regulation of stream flow, yet the examination of the actual flow of the streams of Wisconsin shows no indication of such effect," and "that if any effects on stream flow have resulted from deforestation, they have been entirely counteracted and obscured by the drainage of marshes, the clearing of farm lands, the second growth of timber and brush or other similar occurrences."

The writer agrees with you that the data are incomplete and unsatisfactory and that much longer and more detailed observations are necessary before the question can be entirely settled. He is further of the opinion that different conclusions may be entirely warranted under different conditions and in different parts of the country. He believes, however, that a careful consideration of the data he has presented will show that no effects of deforestation are manifest in the flow of the streams discussed.

In conclusion, if the writer desired to argue in favor of the current theory of the importance of reforestation on the flow of streams, he would reverse your own expression and state that he should hardly wish to advise anyone to cite the Wisconsin River as an example of the effects of deforestation on stream flow.

DANIEL W. MEAD.

*Madison, Wis.*

## Loading of Telephone Cables and Open-Wire Circuits.

*To the Editor of the Electrical World:*

SIR: The article on "Notes on the Loading of Telephone Cable and Open-Wire Circuits," by Messrs. Parker and Cavers, in the issue of July 15, page 165, appears to set forth an erroneous theory and explanation of inductance loading.

The authors say: "The theory of loading is so to balance inductance and capacity in a circuit that they neutralize each other, and, as all telephone circuits contain far more capacity than inductance, it will be necessary to introduce more inductance into the circuits." This statement amounts to applying the theory of lumped inductance and capacity in a simple-series circuit to the case of uniformly distributed inductance and capacity, with resistance and leakage also distributed, as in a uniform line of open wire. The two cases are not alike. In the last case the inductance and resistance are serial with respect to the wire, while capacity and leakage are in shunt.

The ordinary line of open wire is never distortionless except in the critical case, long ago pointed out by Heaviside, when

$$\frac{R}{L} = \frac{S}{C} \qquad (1)$$

At the same time the distortion in a line composed of conductors having unit magnetic permeability is very slight in its ultimate effect. It has been stated by several observers that a little leakage, such as that caused by moderately wet weather, improves the quality, and I believe personally that it is true. Excessive leakage, of course, impairs the volume, because it increases the attenuation, but unless the weather is exceedingly bad and the plant maintenance is poor, the effect of low insulation on non-loaded open wires is only noticeable in a very slight improvement of quality, if noticeable at all. If the transmission is initially very poor, as over a long high-resistance line, leakage then has more effect, of course.

As regards distortion in general, there is far more of it in the terminal apparatus, especially in transmitters, than there is in open-wire lines. In cables, however, the distortion due to the line is more prominent, because there is more capacity and less inductance than in open wires.

The outgoing impedance of an indefinitely long (theoretically infinite) line is numerically

$$K = \sqrt[4]{\frac{R^2 + \omega^2 L^2}{S^2 + \omega^2 C^2}} \qquad (2)$$

and the angle is

$$\theta = \tan^{-1}\left(\frac{\omega C\beta - \alpha S}{S\beta + \omega C\alpha}\right) \qquad (3)$$

When the leakage is zero and the inductance is relatively large (increased artificially), then

$$\beta = \frac{R}{2}\sqrt{\frac{C}{L}} \qquad (4)$$

$$\alpha = \omega\sqrt{LC} \qquad (5)$$

and the outgoing impedance is

$$K = \sqrt{\frac{L}{C}} \qquad (6)$$

while the angle becomes

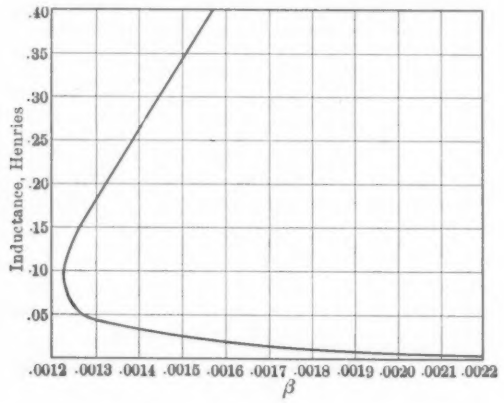
$$\theta = \tan^{-1}\frac{R}{2\omega L} \qquad (7)$$

which is all derived from the general theory of distributed resistance, inductance, capacity and leakage. There is no effect such as the neutralization of capacity by inductance, at any frequency. The angle $\theta$ diminishes as $\frac{R}{2\omega L}$ becomes smaller, but never becomes zero; and $R$ includes not only the apparent resistance of the line wire, but as well the apparent coil resistance per mile of line.

Fig. 2 (reproduced herewith) does not appear to be derived from the expression for attenuation, in terms of resistance, inductance and capacity. As a matter of fact, aerial lines have been loaded with coils having 0.25 henry each, spaced 2 miles apart, or more than 0.1 henry per mile, and there is no observed loss of efficiency by heavy loading. But the difficulties with heavy loading are threefold: First, the gain becomes relatively less as the loading becomes heavier, because of the added coil resistance along with the added inductance. In the next place, heavy loading results in high-line impedance and greater losses from leakage. Lastly, heavy loading results in greater reflection losses at terminals. And, of course, it costs more.

A spacing of 8 miles has been adopted in American aerial practice because it fits the requirements of the transposition system now employed as standard. At the same time, the gain in transmission is substantially as much as with heavy loading.

The quality of loaded aerial lines is no better than, and probably not quite as good as, the quality on non-loaded




Curve Showing Inductance Required to Give Values of $\beta$ for No. 8 Circuit (3.95 Ohms for Loop-Mile).

lines. In the case of cables, however, the quality undergoes a marked improvement by loading.

The air-core coil has been tried, and was abandoned for several reasons. One difficulty lies in securing insulation and durability under weather exposure, without the use of metal housing or protection. Another is the fact that nails, screws or pieces of solid metal, anywhere within the field, raise the apparent resistance appreciably. Still another is the inability to obtain as low a resistance as is possible with the iron-core coil, if properly constructed.

The insulation problem requires particular attention, as American experience demonstrates. Porcelain insulators of a larger pattern have been employed in place of the old pony glass, with much improved results. Maintenance requires more attention for the same reason, and for the further reason that loaded circuits must be carefully balanced in order not to produce cross-talk or inductive disturbances and noises.

*Chicago, Ill.* Frank F. Fowle.

## Improving Telephonic Transmission by Use of Repeating Coils.

*To the Editor of Electrical World:*

Sir:—After reading your editorial comment in the issue of July 15 on the valuable paper on "The Commercial Loading of Telephone Circuits in the Bell System," by Mr. Bancroft Gherardi, printed in full in the July *Proceedings* of the A. I. E. E., I am led to communicate an application of the use of ratio-wound telephone repeating coils in connection with telephone circuits having high-capacity cables as a part thereof, hoping that my experience may prove of use to others having similar conditions to overcome.

The problem of securing satisfactory transmission between Seattle, Wash., and Port Townsend, Wash., was a serious question, inasmuch as there is a 5-mile length of single-conductor government-type telegraph cable forming the link of the circuit between Point Edmond and Apple Cove Point in Puget Sound. This type of cable has an electrostatic capacity of 0.40 microfarad per mile and a resistance of 7.45 ohms per mile, the total capacity being 2 microfarads and the total resistance 37.25 ohms. The wire distance (No. 10 copper) from the shore end to Seattle is 20 miles, and the wire distance from the far end to Port Townsend is 40 miles, 2 miles of the latter being through cables similar to the above, looped and crossing Hoods Canal. The later twin cables, being relatively short and of approximately one-half the effective capacity owing to being looped, are not a serious influence in transmission. However, since it is necessary to have repeating coils at the shore ends of the longer single-conductor cable for translating to and from the loop aerial lines, this section of the circuit introduced disturbances and losses making transmission almost non-commercial.

Transmission was very greatly improved in both strength and clearness by introducing specially made repeating coils having the secondary sections in four balanced sections instead of two and connected in multiple. One terminal of the multiple secondary is connected to the cable conductor and the other to the armor of the cable. The primary windings in series are connected to the line wires in the usual way. It will, therefore, be observed that the line voltages are stepped down to approximately one-fourth through the cable and stepped up again on leaving it. It may be said that the same type of coil was previously used, but connected with the one-to-one ratio.

The fact that the difference of potential determines the "charging current" and that this current is a function of the idle power surging due to the capacity of the cable led the writer to adopt this method of suppressing such losses.

Though there is one station between Seattle and Point Edmond and four stations between Apple Cove Point and Port Townsend, ringing by pole-changer or hand generator is satisfactory. The bells have a resistance of 1600 ohms and have 2-microfarad condensers in series. The repeating coil, which is of the toroidal type, has a total secondary resistance of 30 ohms of No. 26 wire, 1200 turns. The total primary resistance is 35 ohms of No. 25 wire, 1200 turns. Thus the secondary resistance with windings multiplied is 1.875 ohms.

A like connection to a single-conductor cable of the same type is made between Point Defiance, near Tacoma, Wash., and Vashon Island, a distance of 5 miles. In this instance a similarly wound repeating coil of the same make is used. The latter coil has a higher talking efficiency, though a lower ringing efficiency than the other, but high ringing efficiency in this case is not required. While the coils used are specially made to be connected in the one-to-four ratio, the standard coils of this type made in two-section windings may have the windings on the cable side connected in multiple, thus giving a one-to-two ratio. Even this ratio made a decided improvement in transmission. It is to be observed that the cables to which this scheme is applied have a relatively low resistance and a relatively high electrostatic capacity.

While the application above is made to single conductors grounded, a similar improvement may be expected using loop circuits. It should, however, not be lost sight of that introducing two coils where they are not inherently required introduces losses of from ½ mile to 1½ miles standard cable equivalent, and some coils on the market introduce much more; therefore the losses introduced by the coils may in cases overbalance the advantages sought to be gained by their use.

It is sometimes possible so to arrange the cord circuits of switchboards, particularly if the common-battery system is used, that the ratio advantages may be gained without the use of extra coils at the cable terminals. I have in mind where a long cable connects two common-battery exchanges and where it is necessary to use repeating coils in the switchboard due to certain methods of transmission or in order to avoid the noise due to an unbalanced condition such as might exist if direct metallic connection were made to lines over considerable distances or over territory subject to electrical disturbances.

*Portland, Ore.* H. M. FRIENDLY.

# Digest of Current Electrical Literature

**ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD**

### Generators, Motors and Transformers.

*Testing Slip-Ring Induction Motors.*—H. J. S. HEATHER.—The author calls attention to the purely transformer features of the induction motor which render it the electrical equivalent of a stationary transformer of high leakage impedance and variable secondary load resistance. He suggests testing the machine by varying the resistance in the secondary circuit, while keeping the rotor stationary. The input losses, output efficiency, etc., can then be calculated as though the machine were a transformer, corrections being made for the friction loss of the machine running as a motor. This method requires only electrical measurements and the use of only one machine without belts.—Lond. *Electrician,* July 21.

*The Induction Generator.*—J. H. MORECROFT.—An analysis of the operating characteristics of the induction generator, which is an induction motor driven above synchronous speed. The analysis is based essentially on the simplified circle diagram of the induction motor extended into the negative load range. Excitation of the machine by static condensance and operation of the machine under load conditions are explained in simple terms.—Columbia School of Mines *Quarterly,* July.

### Lamps and Lighting.

*Low-Voltage, Metallic-Filament Lamps and Their Importance for Central Stations.*—An article in which it is pointed out that as a result of the introduction of the high-efficiency, metallic-filament lamp the situation of central stations is now worse than before. The only effective remedy is thought to be to get as consumers the mass of people who do not use at present either gas or electric light, but burn kerosene oil. To let them have electric light very cheaply, the use of 10-cp, 10-watt, 20 volt metallic-filament lamps is recommended, fed from 120-volt to 20-volt transformers. The Hegner system is advocated, in which the primary of the transformer is shunted by a condenser to neutralize the exciting current. Experiments were made at the Central Laboratory of Electricity in Paris with an auto-transformer supplying current to eight 20-cp lamps. Without condenser the power-factor was 0.67; with a condenser of 1 microfarad it was 0.835, the current lagging; with a condenser of 1.37 microfarads it was 0.90, the current leading. The condensers used for this purpose are of small size, requiring 0.1 cubic decimeter space per microfarad. They are tested at 700 volts and are, therefore, perfectly safe at 110 volts or 220 volts. Such installations are provided with prepayment meters. For instance, in towns where the kw-hour costs 14 cents, there would be charged with the prepayment meter 2 cents per 100 watt-hours, of which 1.4 cents is the charge for the energy and 0.6 cent the charge for additional expenses.—*L'Industrie Elec.,* June 10.

*Shadow Measurements and Units.*—KONRAD NORDEN.—To modify the formation of shadows in a lighting installation two means may be used: Either subdivide more or less the number of sources of direct light or make use of indirect light. In general, both methods are made use of. The author first defines "diffusion." If the light comes from a single source of direct light, the diffusion is $D = 0$. If the light is infinitely subdivided, that is, perfectly indirect or diffused, the diffusion is $D = 1$. In all other cases the diffusion has a value between zero and unity. A shadow is decreased illumination due to the screening off of the light which comes from one or more sources of light. If a source of light $A$, producing an illumination $a$, is screened off, the "shadow effect" ("Beschattung") is $a$. The "shadow intensity" ("Schattentiefe") depends not only on the shadow effect, but also on the original illumination (which existed when no sources of light were screened off). The reason is that a shadow is a contrast perception; with a total original illumination of 11 lux a single shadow of 10 lux produces almost darkness, while with a total original illumination of 1000 lux a single shadow of 10 lux is hardly perceptible. Shadow intensity $\alpha$ is, therefore, defined at the ratio of the shadow effect $a$ to the total original illumination $E$; that is, $\alpha = a \div E$, hence is always smaller than, or equal to, unity. "Shadow brightness" ("Aufhellung" des Schattens) is the ratio of the illumination which exists in the shadow to the total original illumination $= (E - a) \div E = 1 - \alpha$. Hence, shadow intensity $= 1 -$ shadow brightness. In an analogous way, "shadowness" ("Schattigkeit") $S$ is defined by the relation $S = 1 - D$, or shadowness $= 1 -$ diffusion. For perfect diffusion, $D = 1$, the shadowness is $S = 0$. For the case of one single source of light, $D = 0$, the shadowness is $S = 1$. The author, therefore, introduced the following system of terms and units:

| | |
|---|---|
| Total original illumination $E$ | Shadow effect $a$ |
| Partial illumination $E - a$ | Shadow intensity $a \div E = 1 - (E - a) \div E$ |
| Shadow brightness $(E - a) \div E$ | Shadowness $S = 1 - D$ |
| Diffusion $D$ | |

The author then endeavors to give a general formula for the shadowness in a single point (or rather in an infinitesimal area). The shadowness is determined by the number and intensity of the different shadows 1, 2 . . $n$. Every source of direct light produces a "partial shadow" when screened off. Indirect light produces no shadow. The author shows that the shadowness $S$ can be given by the formula

$$S = \alpha_1^p + \alpha_2^p + \ldots \alpha_n^p$$

where $\alpha_1$ $\alpha_2$ $\alpha_3$ . . are the partial shadow intensities, $\alpha_1 = a_1 \div E$, etc. If all $n$ partial illuminations are equal, then the shadowness $S = (1/n)^{p-1}$. In this case the value of the shadowness becomes a minimum. To use these formulas it is necessary to know the value of $p$. From physiological considerations the author concludes that $p$ cannot be unity, and he shows how it may be possible to decide experimentally whether $p = 2$ or is larger than 2. For the present $p$ may be taken $= 2$ for all practical purposes, as the simplest possible assumption which does not contradict any of the other assumptions. A discussion of applications of this theory is promised for a later paper.—*Elek. Zeit.,* June 22.

### Generation, Transmission and Distribution.

*Kootenay River Hydroelectric Plants.*—L. A. CAMPBELL.—An illustrated description of the plants of the Kootenay Power & Light Company, at Upper Bonnington Falls and

Lower Bonnington Falls. The plant at the former place has a rating of 16,000 hp and that at the latter 4000 hp in turbines driving 60-cycle, three-phase generators. The company owns a third plant at Grand Forks, on the Kettle River, the rating being 3900 hp. Energy is transmitted at 20,000 volts and 60,000 volts. Descriptions are given of the various uses to which the energy is put throughout the Kootenay District.—Toronto *Elec. News,* August.

*Bow River Plant of Calgary Power Company.*—An illustrated description of the apparatus and 55-mile, 55,000-volt transmission lines between Horseshoe Falls, on the Bow River, and Calgary, Canada. The ultimate equipment will have a rating of 20,000 hp. The initial installation consists of two 3750-hp turbines driving two 2500-kw, three-phase, 60-cycle, 12,000-volt generators. The transmission lines are of aluminum cable, supported on pin-type insulators mounted on wooden poles. An overhead grounded wire is carried on each pole.—Toronto *Elec. News,* August.

*Water-Powers on the Winnipeg River.*—E. A. Graham.—The discharge of the Winnipeg River is 35,500 cu. ft. per second as a mean, the maximum being 55,000 and the minimum 16,000. Of the fourteen falls along the river between its junction with the English River and the lake at least four can be utilized profitably for power development, as follows: Point du Bois, 45 ft.; Slave Falls, 25 ft.; Grand Bonnet Falls, 48 ft., and Silver Falls, 45 ft. The total available power at the minimum flow is estimated at 375,000 hp. At Point du Bois 26,000 hp is now being used, while arrangements have been completed for utilizing the power at Grand Bonnet Falls.—Toronto *Elec. News,* August.

*Factory Loads for Central Stations.*—Luther L. Perry.—An article containing practical hints on methods for securing factory motor loads for central stations. The average factory manager is attached to his private plant and is unwilling to concede the numerous advantages of central-station service, principally because he is unacquainted with them. The saving to be secured by employing central-station service must be proved conclusively to the factory manager before he will abandon his isolated plant. To determine definitely the relative cost of isolated plant and central-station service, generalities must be cast aside and the problem attacked in a logical and thorough manner. After an engineer has investigated a private plant his findings should be presented to the plant management in condensed form, arranged systematically and definitely. The writer suggests that such a report be arranged in the following order: Description of the physical plant, its functions, tests, analysis of the present yearly cost of isolated-plant service, how to apply central-station service, estimated yearly cost of central-station service, comparison of the cost and the effectiveness of the existing and the proposed systems of motive power. An abstract is given of a typical report, in which it is shown that the present annual cost of $28,347 in a certain isolated plant could be reduced to $23,324 with central-station service, the saving of about $5,000 being 200 per cent interest on the net cash outlay for changing from isolated plant to central-station service.—*Elec. Jour.,* July.

### Traction.

*Electric Traction in England.*—G. H. J. Hooghwinkel.—An abstract of a paper read at the Congress of the Tramways and Light Railways Association, at Edinburgh. In outlining the reasons why electric traction in England remains stationary, the author shows why railway enterprise does not pay in England as it does on the Continent. In order to make small railway undertakings pay many alterations must be made, including the adoption of the bow collector, light single-deck cars and a more elastic form of track construction.—Lond. *Electrician,* July 21.

*Aluminum Coils for Railway Motors.*—A note on the use of aluminum in place of copper for coils in railway motors. The weight varies from 50 per cent to 55 per cent of copper. In the cost of manufacture there is also a considerable saving, it being shown that a copper coil weighing 68.2 lb. costs $21.40, and an aluminum coil weighing 33 lb. costs $8. In the renewal of the coil there is a saving in favor of aluminum of $3.60.—Supplement to Lond. *Electrician,* July 21.

### Installations, Systems and Appliances.

*Automatic Friction Clutch.*—An illustrated description of the Broadbent automatic friction clutch, which is particularly applicable to electric motors. The clutch comprises

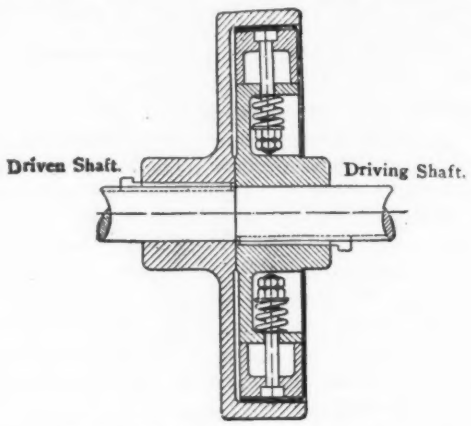



Fig. 1—Section Through Clutch.

a central boss keyed to the motor shaft and carrying friction shoes held in suitable slides. Under the action of centrifugal force these shoes move outward as the speed of the motor increases and they gradually engage with the internal rim of the clutch pulley, by which the torque is transmitted to whatever machinery is being driven. The acceleration of the outer portion of the clutch is quite gradual, and when driving at full speed there is no slip. The clutch can, however, be designed to slip under overload, and in this capacity checks undue strain upon the motor and shafting. The clutch acts as a flexible coupling, in that it prevents shocks or load variations from being transmitted to the motor. The renewable portions of the clutch are comparatively inexpensive and can be replaced in a few moments. They have a long life under the most severe working conditions. The form of clutch illustrated in Fig. 1, in which springs are used, is made so that the engagement of the motor with the outer portion of the clutch takes place only at a certain predetermined speed.—Sup. to Lond. *Electrician,* July 21.

*Steam-Turbine Problems.*—After referring to the problems involved in the design of steam turbines for driving low-speed or moderate-speed machinery, a description is given of the latest type of De Laval turbine and reducing gear. The article is well illustrated.—Lond. *Electrician,* July 21.

*Electric Drills.*—An illustrated description of various types of electric drills, their construction and uses.—*L'Industrie Elec.,* June 10.

### Wires, Wiring and Conduits.

*Cable Jointing.*—Walter E. Rogers.—An article giving directions in detail for making joints in lead-covered cables. The author gives much attention to the making of a "plumber's wiped joint" in the lead covering. In Fig. 2 is shown a special clip for bonding the sheath on a wire-armored cable which is said to have proved very satisfactory in practice. The flanged cones *A, A* are of cast iron, split in a horizontal plane, the two halves of the cones forming a butt joint similar to the butt of the brasses in a high-speed engine cross-head. The provision of, or rather the use of, a butt joint insures that as the outer flanges *B, B* are pulled up the cones *A, A* do not pinch the lead cable sleeve or sheath. The upper part of the figure shows opposite bond-

ing clip cones connected by means of a wrought-iron side rod; whereas the lower half of the figure shows the flanges held together by bolts, the whole being electrically connected by a copper bond, either flexible or solid. Flanges *A, A* should be notched or toothed to receive the side rods,

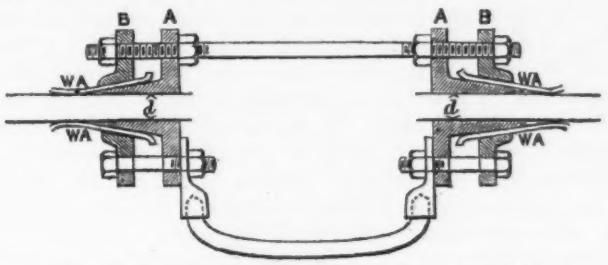



Fig. 2—Special Bonding for Wire-Armored Cable.

while flanges *B, B* must have drilled holes, and these same flanges should be slipped over the cable before the joint is made. For *B B* flanges use can be made of ordinary gas flanges, the thread being removed in a lathe and a cone formed where the thread has been obliterated. The whole of the bonding fittings should finally be thickly coated with hot compound. The author claims that this method of bonding is superior to and more lasting than any form of saddle clip arrangement.—Lond. *Elec. Review,* July 21.

### Electrochemistry and Batteries.

*Magnetic Separators.*—An abstract of a paper by L. B. Woodworth, read before the South African Institute of Electrical Engineers, dealing particularly with magnetic separators suitable for application in the concentration of tin ores. Among the types of separators described is the

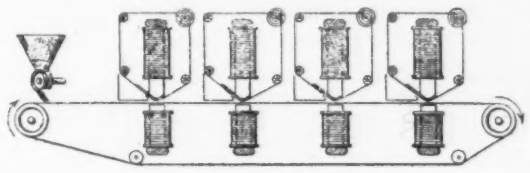


Fig. 3—Improved Separator.

Wetherill-Rowland apparatus, which is provided with cross belts traveling at right angles to the main conveyor belt, upon which the ore is fed from the hopper. The magnetic particles are held to the underside of the cross belts by the magnetic field. One disadvantage in operation of a separator of the cross-belt type is that the particles change their direction of motion when entering a separating zone. The particles travel at a certain speed and direction when on the conveyor belt, and the instant they come under the influence of the upper magnetic pole they are drawn against the under side of the cross belt and travel at increased speed and in a direction at right angles to their former direction. In the separation of tin ore the tin particles have a tendency to move over on the conveyor belt to the side where the throw-off horns are, and in many cases it will be found that tin is carried over. To meet this objection the author proposes the design shown in Fig. 3, where during separation the magnetic particles are drawn up against the under side of the take-off belt of the upper-pole pieces, and without change in direction of motion are drawn up from the throw-off shoe until carried out of the influence of the magnetic field. Further separation can be effected on the spray-pole system in the case of some classes of ores.—Lond. *Elec. Eng'ing,* July 20.

*Copper Smelting in Michigan.*—HENRY D. CONANT.—An illustrated article on the copper-smelting industry in the Lake Superior district of Michigan. In the four smelting plants of the district practically the same means of smelting are used to-day as employed by the Welsh refiners fifty years ago, but the operation of refining has been reduced from an empirical proceeding almost to an exact science controlled by laboratory tests. Descriptions are given of the methods employed at the present smelters, which differ radically in certain particulars.—Columbia School of Mines *Quarterly,* July.

*Magnetic Separation of Ores.*—LUCIUS L. WITTICH.—Electromagnets of various sizes are employed successfully in separating iron from zinc ores in the Missouri-Kansas-Oklahoma district, and in the zinc districts of Wisconsin and Illinois. The present article gives a description of the processes used in mills at Joplin, Mo., and Galena, Ill.—*Mines and Minerals,* August.

*Electricity in Copper Smelter.*—LEROY A. PALMER.—In the Tooele smelter of the International Smelting & Refining Company, 34 miles west of Salt Lake City, Utah, extensive use is made of electric motors for driving the machinery. The motors are of both the direct-current and alternating-current types. The generating station contains two 250-kw, 550-volt direct-current generators and two 750-kw, 2200-volt, three-phase alternators. The author describes the method of sampling and handling ore by conveyors and the process of roasting and converting.—*Mines and Minerals,* August.

### Electrophysics and Magnetism.

*Electric Vacuum Valves.*—OLIVER LODGE.—An account of an experimental investigation of the electric vacuum "valve," which permits the passage of electricity in one direction only, or at least very much more readily in one direction than the opposite. The experiments described were performed with an unsymmetrical tube provided with a supplemental path, in which a tap was inserted. Each end was made successively positive and negative, the tap being first open and then closed. Observations were made of the cathode rays produced and of the local heating within the tube. The author stated that the fact that conveyors of electricity have to change in sign when current passes from a metal to a gas or from a gas to a metal, which exchange can be effected only by a neutralization or combination of the opposite charges at the bounding surface, suffices to account for some of the heat which is there developed.—*Phil. Mag.,* July.

*Properties of Selenium.*—G. L. ADDENBROOKE.—An account of a number of researches on the physical properties, more particularly its specific resistance and specific inductive capacity.—Lond. *Electrician,* July 21.

### Units, Measurements and Instruments.

*High-Tension Electrostatic Wattmeters.*—ERNEST WILSON.—An abstract of a (British) Physical Society paper giving details of the electrostatic wattmeter outlined on

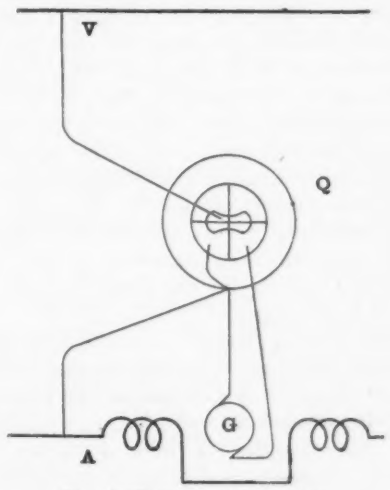



Fig. 4—Tension Wattmeter.

page 1573 of our issue for June 15, 1911. A high-tension wattmeter, the moving system of which is subjected to the full voltage of the supply system, is shown diagrammatically in Fig. 4. The quadrants are connected to a small air-cored generator *G,* which rotates in a magnetic

field produced by and proportional to the current $A$ in the work circuit. This generator is driven at known speed by a small motor, which can be either direct current or alternating current. It was found that when the emf $V$ impressed upon the moving system is of the order of 20,000 volts or more the quadrants require a considerable voltage in order that accuracy and stability may be secured. In addition, the brushes of the generator have to be carefully adjusted so as to eliminate transformer action. The following are a few particulars of one form of generator which has yielded good results: The armature is of the two-pole type and is wound with 100 sections, each having fifty turns and an area for magnetic flux of 130 sq. cm. The commutator has 100 parts. The field coil is built up of copper strip 2 in deep by 1/32 in. thick, and has four sections connected to blocks in such wise that they can be used in parallel or series or parallel-series groupings. The number of turns per section is ten. The speed of rotation is 3600 r.p.m., and is registered by a Hartmann & Braun speed counter, capable of detecting a variation in speed of 0.3 per cent. The curve of voltage between the generator brushes was determined for various positions of a rotating contact-maker fixed to the shaft of the alternator and compared with the curve of current in the field coil. The agreement was as close as could be demonstrated by the method of test. The electrometer in its first form resembled Kelvin's quadrant electrometer. The suspension was made of phosphor-bronze strip, and the vanes, two in number, were each 10¾ in. long by about 4 in. broad at their widest part. In a later form of the instrument the quadrant pairs are the moving system and are suspended by phosphor-bronze strip between two fixed sectors, which are heavily insulated and capable of withstanding several-fold the normal voltage of the instrument. The suspended quadrants are 9½ in. in diameter and are 1¾ in. from the fixed sectors, the instrument being designed for 15,000 volts. The instrument obeys the straight-line law, is accurate on low power-factor and has a sensibility such that on a scale 50 in. distant from the mirror the kilowatts per millimeter deflection are 1.82 when the generator field coils are four in series.—Lond. *Electrician*, July 7.

**Telegraphy, Telephony and Signals.**

*Train Dispatching on the Northern Electric Railroad.*—L. H. Baldwin.—Along the third-rail electric railway operating between Sacramento, Chico and Oroville, Cal., three distinct ways of communication have been provided: A dispatcher's circuit for dispatching trains, a straight magneto telephone circuit for commercial work, and a Morse telegraph circuit for emergency work. The telegraph instruments are looped from one side of the commercial circuit, condensers being used to prevent interference with the telephone voice currents of the calling currents. The interconnections of the various instruments are explained by means of a wiring diagram and a brief description.—*Jour. Elec. Power and Gas*, July 22.

## Book Review.

Essais des Machines a Courants Alternatifs. By G. Ferroux. Paris: L. Geisler. 184 pages, 131 illus. Price, 2.50 francs.

An excellent textbook on the factory testing of alternating-current machines from the engineering point of view. The work is divided into nine chapters, entitled as follows: Special apparatus for measuring alternating currents; magnetic tests of an alternator; tests of alternators; efficiencies of alternators; tests of transformers; measurement of the efficiency of a transformer; tests of synchronous motors; tests of asynchronous motors; tests of converters and commutator motors. The description is clear and the treatment largely geometric and vectorial. The book will be useful to engineers constructing alternating-current machines and interested in French practice.

# New Apparatus and Appliances

### RELATIONS BETWEEN ELECTRICAL SALESMEN AND BUYERS.

At the meeting of the Electric Club of Chicago on July 26 Mr. James H. Delany reported the answers he had received to questions he had put to a number of purchasing agents in relation to the characteristics of electrical salesmen. These purchasing agents represent railroad, steel and general manufacturing companies, and several of them gave their opinions of electrical salesmen freely, on the promise that their names should not be made public. In general the purchasing agents seemed to think, according to Mr. Delany, that electrical salesmen are rather superior to other salesmen calling on the same buyers and exhibit more technical knowledge.

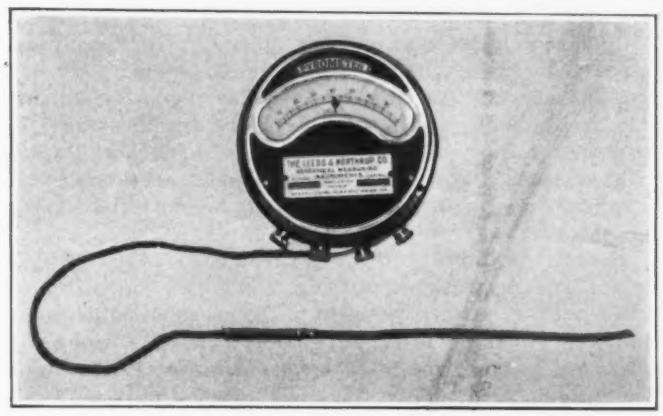
In the discussion Mr. Hugh A. Brown remarked that the bigger the manufacturing organization the more it tends toward standard apparatus and the harder it is to get special types of apparatus. Messrs. W. R. Bonham and Albert Scheible discussed the relations of electrical manufacturers, electrical salesmen and purchasing agents of buyers in placing orders for special apparatus. This subject aroused some attention. Mr. Bonham said that often the salesman has more authority in selling than the purchasing agent who criticises him has in buying. Mr. Scheible remarked that on special work the manufacturer will want the salesman to consult him and not commit him to some new thing without his knowledge. Mr. F. J. Postel said that when special machinery is ordered the salesman can help the purchasing agent or engineer by making suggestions. Often where a change from the standard line is desired a considerable variation is permissible, and salesmen should make intelligent suggestions in relation to dimensions and speeds of, say, an electric motor, which may be nearly the same as those specified and which may answer. The engineer will always welcome a salesman who can tell him something he does not know about electrical machinery by describing intelligently the apparatus offered.

Mr. Delany told of an electrical manufacturer who said that if the "bucolic consulting engineer" could be abolished the customer could get his apparatus 25 per cent less and make 100 per cent more profit. This unnamed man whom Mr. Delany quoted said that many consulting engineers make trivial objections to standard apparatus in order to impress their clients. Mr. S. F. Joor, a consulting engineer, defended the engineer. He said that the trouble with the salesman is that he does not keep his information where he can use it. The engineer will almost always use standard machinery and appliances if he can do so. Mr. Postel, who is also an engineer, pointed out the lack of standardization in the matter of speeds and dimensions of electrical and steam machinery. Engineers obviously are placed at a disadvantage in relation to specifying standard apparatus when there are so many standards, each with vociferous advocates.

## RESISTANCE THERMOMETER.

In temperature tests of electrical machinery a mercury thermometer is at a disadvantage owing to its shape, which confines its indications to surface temperatures. While machines have been rated on an assumption that at the center the temperature is a given number of degrees higher than at the surface, this is at best unsatisfactory, since the difference in temperature between the surface and the center varies with room temperature, the condition of the machine, its freedom from dust, etc. If the true temperature of the center of the machine, or of the point where the temperature is highest, could be measured with accuracy there would be no guesswork in fixing the rating, and in some cases it would be found that a machine could be operated with larger output than that indicated by the approximate method.

In order to measure the temperature at the point desired copper coils with exterior leads have been built into the center of the machine; then by measuring the resistance of the coil the temperature within the machine can be calculated. While such coils when properly built are capable



Resistance Thermometer.

of a high degree of accuracy the method is open to the objection that the readings are not in terms of temperature, but of resistance. Moreover, the arrangement is usually such as to require the services of the testing department, while the information is needed at frequent and irregular intervals by the operating department.

To meet the situation above outlined the Leeds & Northrup Company, of Philadelphia, has devised a resistance thermometer which by its shape and its freedom from external electrical effects is especially adapted to the measurement of temperature of electrical machinery. As shown in the accompanying cut, the resistance thermometer consists of two parts, the indicator and a resistance winding called the "bulb." The indicator employed resembles an ordinary switchboard ammeter except that the scale is in temperature units. The particular novelty in the design lies in the "bulb," which for this service is only 1/25 in. in thickness and so flexible that it may be rolled like a ribbon, and is so protected that persistent scratching with a knife edge is required to injure it. The winding of the "bulb" is non-inductive and, as there is no metal present in such a form as to be heated by eddy currents, the arrangement is unaffected by alternating-current fields.

All "bulbs" being electrically adjusted to a standard, they are interchangeable and any number may be used with one indicator through a selective switch. The length of the leads is without effect upon the readings, and hence the reading device—or, as it is called, the indicator—may be at any distance from the "bulbs." In actual work a number of thin "bulbs" are inserted into the stator parts of a machine, each connected by three-wire leads to a selective switch located at the indicator. All are read at intervals and that one which shows the highest temperature is left permanently in circuit.

The temperature indicator resembles in appearance and in mechanical details the conventional small-pattern switchboard voltmeter. Though the scale does not indicate the fact, the instrument has, in reality, a central zero adjustment. That is, when the current is turned off the pointer stands opposite the center of the scale. The instrument requires an external source of electric power, which may be of any voltage between 12 volts and 250 volts, although voltages much over 110 are not recommended.

The connections are those of a differential millivoltmeter or a milliammeter. Hence when the system is balanced there is no deflection, regardless of the magnitude of the current flowing; the accuracy is thus in principle independent of the voltage of the source and practically this holds between wide limits. Thus on the range 10 deg. C. to 90 deg. C. a fluctuation of 2 per cent in the voltage of the source would introduce no error whatever at 50 deg. C.; at 30 deg. and 70 deg. the error would be 0.5 per cent, and 1 per cent at 10 deg. and 90 deg. For all ordinary conditions in central stations this error may be regarded as negligible.

The wiring is similar to that required in an Edison three-wire lighting system, all three wires being well insulated against the ground. The size of the wire is without effect, the only requirement being that all three leads shall be of the same length and material.

## GASOLINE-ELECTRIC CAR FOR SAN FRANCISCO RAILROAD

The gasoline-electric motor car, with its reliability, low operating cost and flexibility of control, combined with luxurious accommodation and freedom from cinders, smoke and coal gas, has proved well suited for railroad service. The St. Louis & San Francisco Railroad Company has recently put six of these cars in service.

The cars are 70 ft. long and 10 ft. in width over the sills, with turtle-back construction of roof, pointed front end and observation rear platform. The cars are designed with special reference to light construction with adequate strength. The interior arrangement is designed to meet the Southern traffic conditions, providing separate accommodations and entrances for white and colored passengers. Ventilation is accomplished through large suction ventilators located on the center of the roof, the openings protected by ceiling register plates. The entire car, including platforms and vestibules, is lighted by electricity. The partition between the baggage-room and negro compartment is movable and may be arranged to give the baggage compartment a length of 8 ft. or 10.5 ft. to suit traffic requirements. The car is heated by hot water circulating in four lines of pipe on each side of the car. Only one end of the car is equipped with a pilot, inasmuch as the car is designed primarily for single-end operation. Equipped and ready for operation, the car will weigh in the neighborhood of forty-eight tons.

The generating equipment is located in the cab at the front end of the car and consists of a main gas-engine generating set consisting of an eight-cylinder gasoline engine with direct-connected generator. There are also an auxiliary gas-engine generating set with integral air pump and lighting generator; equipment for motor control; air and hand-brake systems; pneumatic bell ringer, sander, warning and signal whistles and a coal-fired hot-water heater. One motor is mounted upon each axle of the front truck.

The main gas engine is of the four-stroke cycle "V" type. The generator magnet frame is bolted to the frame of the gas engine, which rests upon the floor of the car with cushion support. The speed of the engine is adjusted by a throttle, the normal speed being 550 r.p.m. The cylinders are 8 in. in diameter with 10-in. stroke.

The main generator is of the commutating pole type designed specially for heavy traffic work. The entire machine is inclosed within a three-arm bracket which supports the outer bearing of the generator armature.

The motors are of the box frame, commutating-pole, oil-lubricated type, known as standard GE-205, 600-volt, 100-hp railway motors. Energy to the motors is supplied through cables in conduit from the generator.

The auxiliary gas-engine set consists of a three-cylinder, four-stroke cycle, vertical-type gas engine, the center cylinder being used as an air compressor. The lighting generator is directly connected to the gas engine with armature of the overhung type. The air pump on this engine is capable of delivering 45 cu. ft. of free air per minute and will charge the tanks to a pressure of 90 lb. in about ten minutes. This pump is used to supply air for starting the main engine after it has been idle if pressure in the main reservoirs has gone down. The auxiliary gas engine is started by hand.

The operator's seat is at the right-hand side of the cab beside a sliding window. All the control, air-brake and signal apparatus is conveniently located at this point and so arranged that the car and engine may be controlled without the operator leaving his seat.

One of the distinguishing features of these cars is the flexibility of control. Energy is delivered to the motors from the main generator through a controller of a type similar in appearance to those used in trolley-car practice. Concentric with the electrical controller handle, but above it, is an air-starting throttle handle. This handle is so arranged that by pressing a lever air for starting the engine may be admitted to the engine distributing valve through an air valve mounted upon the car plate of the controller, at the same time opening the throttle. Provisions are made, however, so that the throttle may be open only to a set distance and hence racing of the engine is avoided. The engine having been started, the lever may thereby be released, cutting off the air pressure, and the throttle opened wider. It is not possible to admit air again to the engine without returning to the initial point, thus closing the throttle.

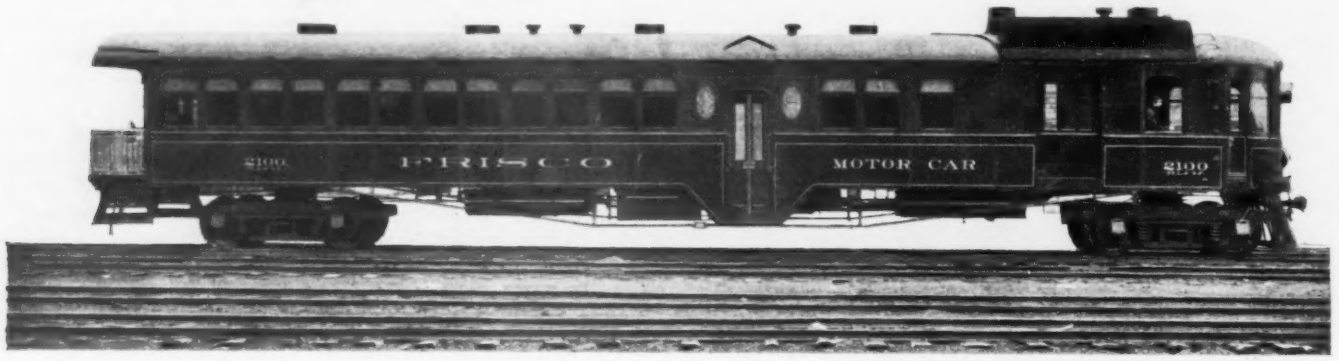



Fig. 1—Gasoline-Electric Motor Car.

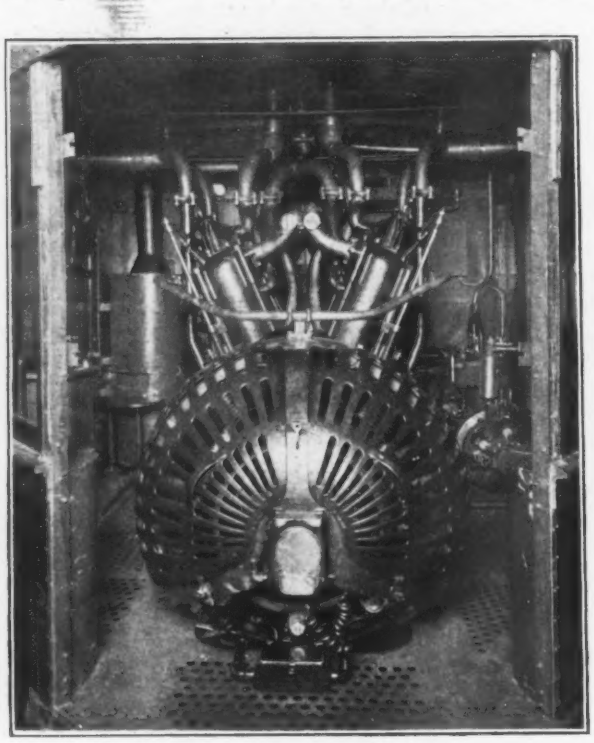


Fig. 2—Main Gasoline-Engine Generating Set.

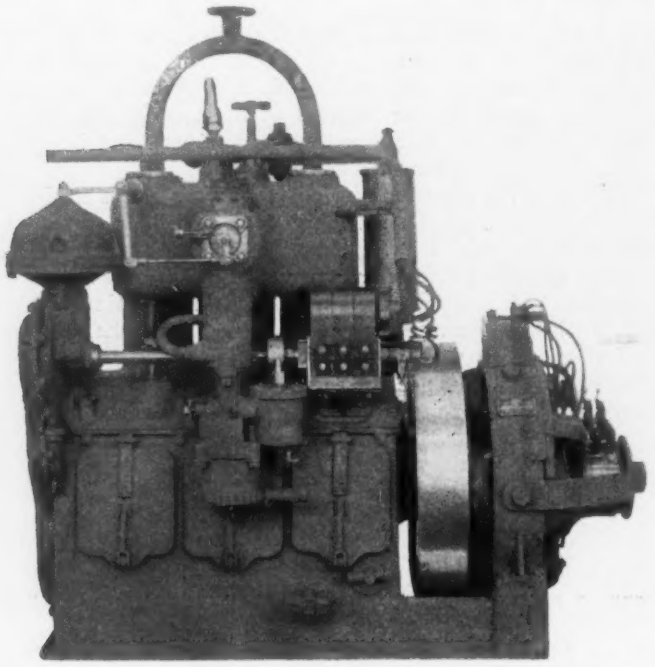


Fig. 3—Auxiliary Gasoline-Engine Generating Set.

Energy for lighting the car is supplied from the generator driven by the auxiliary gas engine. Each lamp is fitted with an attractive shade. The electric lamps in the cab are protected by glass globes inclosed within steel cages. Condulets for attachment plugs are also provided, one on either side of the cab. The head lamp is equipped with a 50-cp unit and there is also provided a gage lamp which is controlled by a switch convenient to the operator. The gage lamp and head lamp are on a separate circuit from the cab lamps. Switches and fuses for the lighting circuits are mounted in a cabinet which is fastened on the wall.

The car is heated by hot water supplied either from the

gas-engine jackets or from a coal-fired Baker hot-water heater located in the corner of the cab, which is fired from the baggage-room. Provision is made so that hot water from the coal heater may be circulated through the engine jackets and radiators to prevent freezing on cold nights or during layovers.

The gasoline storage tank is located beneath the baggage room. Gasoline is supplied to the tank through a filler on the outside of the car with suitable strainers and filters. There is in addition a vent pipe to the roof.

There are three air reservoirs located under the car and so arranged that the air taken from these reservoirs for starting the engine does not drain the brake reservoirs. There is also a reservoir for the signal and warning whistles.

The trucks are of the swing bolster type, the frames being of boiler-plate steel with pedestal shoes of cast iron. The bolster springs are triple elliptic and the equalizer springs triple coil. The wheels are 36 in. in diameter. Each truck has a wheel base of 7 ft., the total wheel base of the car being 58.5 ft. The car represents the latest designs of the General Electric Company.

## THE ELECTRICALLY DRIVEN POWER PUMP VERSUS THE DIRECT-ACTING STEAM PUMP.

In selecting equipment for the modern power plant, efficiency is the one consideration that should never be lost sight of. Before deciding upon the type, class or arrangement of equipment the builder should know first of all which will show the greatest operating economy. Data from actual installations showing comparative efficiencies are, therefore, always interesting to the man concerned with the installation or operation of power plants. In every power plant the water-supply system is one of the items that have to be considered. Its importance varies widely, of course, with the type of plant, the service required of the water-supply system, etc. In the average plant, however, it will be found that this item is one worthy of very careful consideration. The efficiency of the motor-driven power-pump equipment is generally recognized as being considerably better than that of the steam pump under ordinary conditions. As giving a direct and definite comparison between the two the installation consisting of both types of pumps in the Security Mutual Life Insurance Building, Binghamton, N. Y., is interesting. In this plant the pumps referred to are for operating the hydraulic elevators. The equipment consists of two Goulds 8-in. x 10-in. triplex pumps, each belt-driven by a 40-hp motor. The pumps operate against a pressure of 170 lb. per square inch. In addition there is a tandem duplex steam elevator pump, which is no longer used regularly, but held in reserve as a result of the large saving claimed to be shown by using the electrically driven pumps. When the comparative tests were made data were taken from a two days' run with the steam pump and then identical data were taken from a two days' run with the electrically driven pumps. In the two days the electrically driven pumps showed a saving over the steam pump of 4581 lb. of coal. The average number of trips per day made by the elevators for the two days when the steam pumps and the electrical pumps were operating was very nearly the same, being 882 with the former and 850 with the latter. Aside from the coal saving the maintenance expense is said to have shown a large balance in favor of the electrically driven pumps. It is also interesting to note that in this plant the steam-pump cylinders are carefully jacketed and the pumps operated under the most favorable conditions.

Another point made in favor of the electrically driven pumps is that the motors are controlled automatically; they start or stop themselves as soon as the water pressure drops or rises to a certain point. In this way a uniform pressure is maintained and practically no attention need be given the pumps, which were supplied by the Goulds Manufacturing Company, Seneca Falls, N. Y.

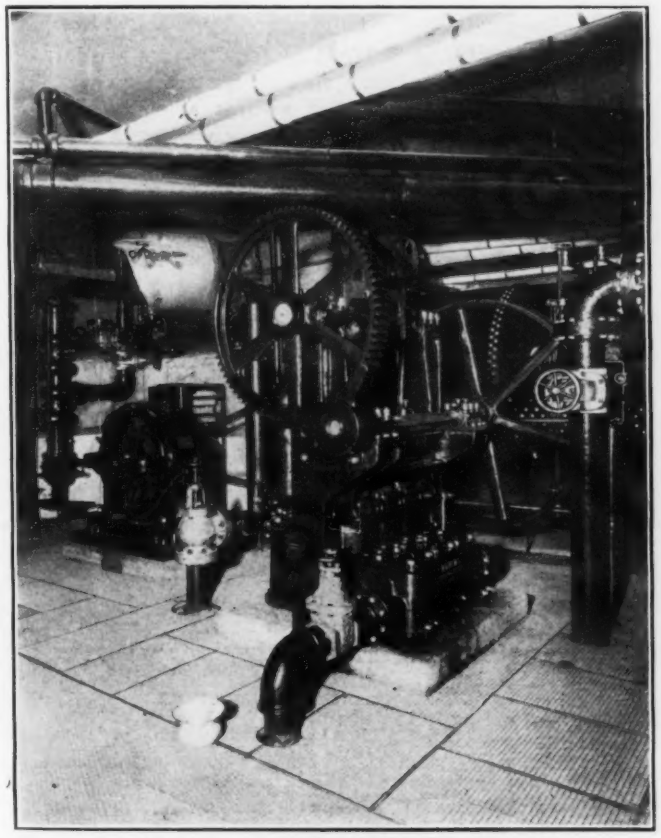


Fig. 1—Triplex Pumps in the Security Mutual Life Insurance Building, Binghamton, Driven by a 40-hp Motor.

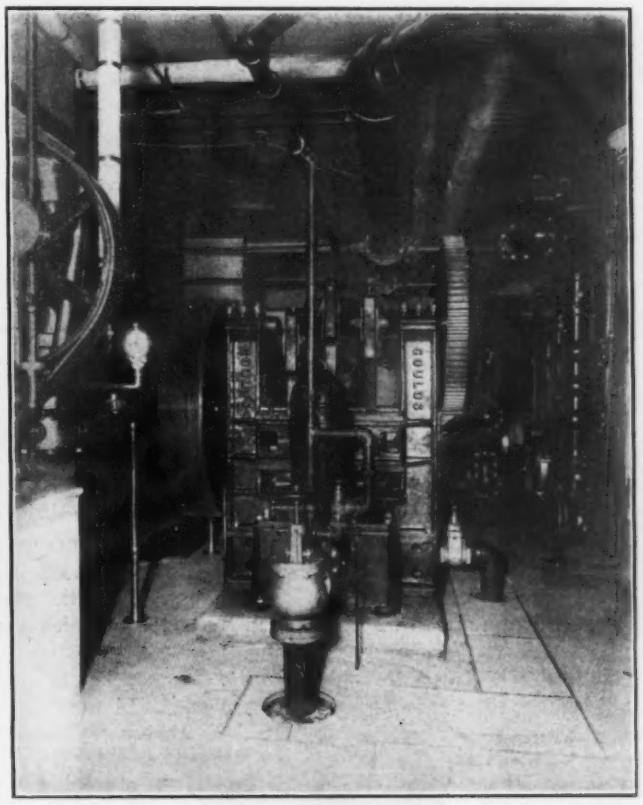
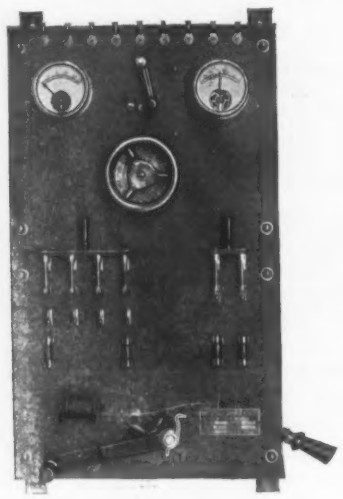



Fig. 2—View Showing Triplex Pump in the Foreground and the Steam-Pump Equipment It Replaces in the Background.

## BATTERY-CHARGING PANELS FOR SMALL GASOLINE-ENGINE SETS.

In country homes and clubs and on farms where central-station energy is not available gasoline-engine-driven generating sets with storage-battery equipment have come into extensive use. On the farm the engine has already been



Battery-Charging Panel.

used for general power purposes for some time, and the addition of a generator and battery, with battery-charging panel, provides energy for lighting at night when the engine is not usually run.

Designed especially for this kind of service, the Cutler-Hammer Manufacturing Company, of Milwaukee, has recently put on the market an inexpensive and compact combination battery-charging and generator plant, illustrated herewith. The upper part of this panel carries the terminals, voltmeter, ammeter, voltmeter switch and generator-field rheostat, the handle of which is mounted on the front of the board. The lower section carries a four-pole, double-throw battery switch, a generator switch, a low-current battery cut-out and the necessary fuses. By means of the voltmeter switch the voltage of either half of the battery when charging, the total voltage on discharge, or the generator voltage when the main switch is closed can be read. The low-current cut-out provided prevents the discharging of the battery back into the generator should the generator voltage be decreased for any reason.

## NEW DIRECT-CURRENT MOTOR.

The Westinghouse Electric & Manufacturing Company is placing on the market a new direct-current motor for general power service, known as "Type SK." The new motor has a number of novel features and embodies the

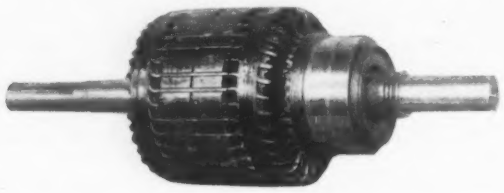


Fig. 1—Rotor of Direct-Current Motor.

most advanced design in direct-current machines. One of its strongest features is excellent commutation, which is obtained partly by the use of commutating poles and partly by the careful design of the commutator, brushes and brush holders. Service tests have shown practically sparkless commutation under all conditions of speed or load up to extreme overloads. Another characteristic of importance is the large dust-proof bearings and the efficiency of the oiling system. Large oil rings keep the bearing surfaces well lubricated whenever the motor is in operation, but the oil cannot leak or be thrown out of the oil well.

As can be seen from the accompanying illustrations, the motor is very simple in construction. The frame, which is of a new design, is a ring of open-hearth steel made by hot-rolling the slab into shape and welding the ends

Fig. 2—Stator of Direct-Current Motor.

together. Rolled steel is an ideal material for motor frames because of its high magnetic permeability, uniform structure and great strength. The feet are pressed from steel plate and are riveted under great pressure, making a very rigid construction.

The armature is so wound that wide spaces are left between the ends of the coils and air ducts are provided in the core, an arrangement that assures ample ventilation. The coils are form-wound, laid in open slots and held by fiber wedges and bands. The shaft can be pressed out without disturbing the armature windings and commutator connections.

Fig. 3—Direct-Current Motor Complete.

These motors are made for 115 volts, 230 volts and 550 volts in capacities of from 1½ hp to 50 hp. The speeds correspond closely to the full-load speeds of induction motors, thus simplifying the application of motors and making comparatively easy changes from motors of one class to those of another.

# Industrial and Commercial News

### THE WEEK IN TRADE.

CONDITIONS have not changed materially in the past week and business continues in its slow recovery from the period of depression. Approach of the fall season has added stability to the advancement of recent weeks, and this has been further strengthened by a wider scale of buying for the season's requirements. Improvement is marked in the Southwest as a consequence of excellent crops, and abundance of rain has done much to engender optimism. Stock owners are greatly encouraged by good pasturage and by the indications for a fair corn crop. Building and railroad operations in the Southwest are reported as progressing satisfactorily and general trade in the territory is advancing. In many of the sections, while the tone is better, the volume of trade is as yet curtailed, but the beneficial influence of the crop movement is now becoming widespread and the country is responding at a rate commensurate with the period of the year. From the present volume of inquiries further expansion is looked for in the steel trade, and preparations for increasing output are in progress at many mills. Blowing in of several furnaces has widened the activities in the coke fields. Reports of concessions on prices of finished products are fewer in number and the movement for lower rates has apparently been blocked by the large interests. The tone of the steel market in general is encouraging, and the only uncertain factor in the iron and steel situation at this time seems to be in the pig-iron market. Some fair tonnages have been disposed of, but orders are fewer in number than had been expected and the impression is given that most of the large producers are stocked for present needs. Politics is probably exerting a more important influence upon business at this time than any of the other elements concerned, and while the presidential campaign is yet too distant to be of great importance in the immediate affairs of the country, there is no doubt that a moderate setback can be expected from this source later in the year. Business failures for the week ended Aug. 3, as reported by *Bradstreet's*, were 208, as compared with 241 for last week, 166 for the same week in 1910, 184 in 1909, 205 in 1908 and 157 in 1907.

### THE COPPER MARKET.

COPPER stocks in the United States decreased 19,695,306 lb. in the month of July, according to the report of the Copper Producers' Association issued on Tuesday of this week. The showing for the month was by far the most favorable during the present year. Stocks on hand throughout the country, as of Aug. 1, were 137,738,858 lb., as compared with 157,434,164 lb. for June. Production for the month was 112,167,937 lb., the smallest since February, when the total was 109,828,297 lb. July shows a reduction of 12,386,378 lb., as compared with June and a decrease of 6,000,000 lb. in comparison with July, 1910. Much of the curtailment is attributed to extremely hot weather at the smelters in the past month. The decrease is larger than had been expected and is the most gratifying item in the monthly statement. Domestic deliveries were 56,982,582 lb., as compared with 61,655,561 lb. in June and 64,543,963 lb. in the month of May. While this figure was less than had been hoped for, some satisfaction is found in the fact that the total deliveries are fully up to the average for the year. Exports were the largest in the present year, reaching 74,880,658 lb., as against 71,460,519 lb. in the preceding month.

| Standard Copper. | Bid. | Asked. | Settling Price. |
|---|---|---|---|
| Spot | 12.17½ | 12.37½ | .... |
| August | 12.20 | 12.37½ | 12.30 |
| September | 12.20 | 12.37½ | 12.30 |
| October | 12.20 | 12.37½ | 12.30 |
| November | 12.20 | 12.37½ | 12.30 |

The London market, August 8, was as follows:

| | Noon. £ | s | d | Closing. £ | s | d |
|---|---|---|---|---|---|---|
| Standard copper, spot | 56 | 7 | 6 | 56 | 7 | 6 |
| Standard copper, futures | 57 | 2 | 6 | 57 | 2 | 6 |

| Extreme fluctuations for this year. | Highest. | | | Lowest. | | |
|---|---|---|---|---|---|---|
| Standard | 12.35c | | | 11.57½c | | |
| London, spot | £57 | 10 | 0 | £53 | 7 | 6 |
| London, futures | 58 | 2 | 6 | 54 | 0 | 0 |
| Best selected | 61 | 10 | 0 | 57 | 5 | 0 |

Trade has been extremely dull pending the report of the association, as consumers have desired to ascertain the volume of surplus stocks and the probable trend of prices. Inquiries have been very few in number and the prospects for good business are not attractive. The large interests are holding out for 12¾ cents. Very little of importance has taken place in the London market during the week, and prices have not changed materially. Exports for the month, including Aug. 8, were 5660 tons. The daily call on the Metal Exchange, Aug. 8, quoted copper as per the accompanying table.

### INDUSTRIAL AND COMMERCIAL NOTES.

**New York Edison Company Opposes Long Acre Grant.**—Following approval by the Public Service Commission for the First District of New York of the Long Acre Electric Light & Power Company's application to issue $2,000,000 in stock and $4,000,000 in bonds in accordance with conditions named in these columns Aug. 5, the New York Edison Company has filed a petition requesting a rehearing of the case. It is asserted in the petition that the majority opinion of the commission which authorized the issuing of the securities did not take into consideration certain new evidence that was offered in the case and that failure to recognize this is not only a source of injury to the Edison company, but also a proper ground upon which to request a rehearing. It further alleges in the petition that there is no public necessity for a competing company in Manhattan and the Bronx, and that the New York Edison Company has made large investments which will be much affected by such competition if permitted. It is also stated that the New York Edison Company has recently reduced the price of electricity and that no complaints of injustice in connection with its rates have been made to the commission.

**Proposed Michigan Hydroelectric System.**—The Consolidated Light & Power Company has been organized in Michigan to erect hydroelectric plants on the Chippewa River for furnishing energy to about thirty towns, among them Midland, Ionia, St. Johns, Ithaca and Mount Pleasant. The capital stock is fixed at $100,000, the land value of the property held by the company. The officers are all Detroit men, and are as follows: President J. L. Hudson; vice-president and general manager, Charles S. Abbott; secretary, Robert Tannehill; treasurer, F. R. Ross. The company now has two dams across the Chippewa River and seven more will be built. It is said the hydroelectric value of the property now owned by the company will run well over $1,000,000 and that the company will probably be the largest in the State when its properties are developed.

**Sale of Winnipeg Public Utilities.**—It is announced that Sir William MacKenzie, president of the Winnipeg Electric Railway Company, will go to Winnipeg to conduct personally the negotiations for the sale of the company's gas and electric-light plant and street-railway system to the corporation of the city of Winnipeg. It has been stated that a price of $250 per share has been placed on the stock of the company, and while Mayor Evans has intimated that the Council will in all probability accept a proposition for the purchase of the system by the city it will be necessary for the ratepayers to pass upon the by-law to be submitted to them authorizing the raising of the required amount of money for the purchase.

**General Electric Order.**—The Delaware & Hudson Company, Albany, N. Y., has placed an order with the General Electric Company for one 7500-kw turbine, one 100-kw turbo-exciter and four 2500-kva transformers. This apparatus will give an increased power supply to the electric traction interests of the company in Albany, Troy and Schenectady and will also furnish power for the new shops of the company at Watervliet, N. Y.

**To Close Plant of American Fuse Company.**—The creditors of the American Fuse Company, which was involved in the financial operations of its president, Frank G. Jones, described in the issue of June 22, have decided that the business is not of a profitable nature and have made arrangements for closing the plant at Muskegon, Mich. About 600 men will be thrown out of employment.

**Hall Signal Company Reorganization.**—Newman Erb, vice-chairman of the reorganization committee of the Hall Signal Company, has issued a circular to depositing stockholders calling attention to the necessity, in case business is to be carried on under normal conditions pending reorganization, of obtaining sufficient funds at once to supply the company with working capital and to acquire by purchase the current supply bills against it. Contracts and orders on hand cannot be properly filled until this assistance is given. It is reported that the committee has plans under consideration for arranging a readjustment of the affairs of the company and that plans are being made for merging with another company. It is the desire of the committee, in the partial development of its plan under the deposit agreement, to incur obligations for the present not in excess of $100,000, to purchase current material and supply accounts against it. It is stated that over 85 per cent of the capital stock of the company has been deposited with the Empire Trust Company and that money will be borrowed on behalf of the depositing stockholders against the stock deposited. No personal liability will be incurred. An agreement empowering the readjustment committee to proceed with steps for obtaining the $100,000 was sent to the stockholders. J. S. Bache, Newman Erb, W. F. Morgan, W. P. Hall and G. O. Horwitz comprise the committee.

**Pittsfield Electric Company Elections.**—At the recent meeting of stockholders of the Pittsfield Electric Company, of Pittsfield, Mass., the old board of directors was re-elected as follows: W. L. Adam, Samuel G. Colt, Alexander Kennedy, Charles E. Merrill, Henry R. Pierson, Arthur H. Rice and W. A. Whittlesey. Alexander Kennedy was re-elected president and treasurer of the company, W. L. Adam was elected clerk and W. D. Whittlesey made superintendent of the company. During the year the amount of energy sold was 17 per cent larger than in the previous year, but owing to reduction in rates for lighting on January 1 net earnings showed but slight increase. Mr. Kennedy has been president of the company since its incorporation in 1882.

**Central-Station Service for a Massachusetts Steel Company.**—The Worcester Pressed Steel Company has contracted with the Connecticut River Transmission Company for energy to drive 600 hp in motors, with a twenty-four-hour load. The Connecticut River company will supply three-phase, 60-cycle, 13,200-volt alternating current and this will be transformed to 500 volts. Contracts for the transformers, switchboards and motor-generator set have been awarded to the General Electric Company and contracts for the motors have been placed with the Westinghouse Electric & Manufacturing Company.

**Boston Elevated Plans.**—Notice has been given to stockholders of the Boston Elevated Railway Company of a special meeting to be held Aug. 24 for deciding whether the company shall purchase the properties and franchises of the West End Street Railway Company. A circular, signed by President Bancroft and the directors of the company, has also been sent to the stockholders and contains the unanimous recommendation of the signers for purchasing the franchises of the West End company.

**New Cable Service to Nova Scotia.**—The Western Union Telegraph Company has instituted a new and direct telegraph and cable service from Boston to Canso, N. S., the terminus of three cable lines to Europe. The new arrangement gives greatly improved facilities for the transmission of cablegrams directly to the submarine lines. The Western Union has established its cable department on the ground floor of its office at 109 State Street, Boston.

**Texas $12,000,000 Irrigation and Hydroelectric Project.**—The Medina Irrigation Company, organized by Dr. F. S. Pearson, has enlarged its plans for irrigation and hydroelectric projects in South Texas from a cost of $6,000,000 to $12,000,000. The present plans provide for dams and storage reservoirs on the Medina, Guadalupe, Frio and Nueces Rivers.

**Allis-Chalmers Changes.**—Announcement is made that the Scranton plant of the Allis-Chalmers Company will be closed about Jan. 1 and that the hydraulic department will be located in Milwaukee, while the sugar-machinery department will be brought to Chicago.

**Aluminum Notes and Prices.**—The market for aluminum is quiet but firm, with ingots for remelting held at 20@20½ cents, spot No. 1, the base for large ingots. Rods and wire are 31 cents, and sheets are 33 cents, prices as of Aug. 8.

# *Financial.*

## The Week in Wall Street.

WEAKNESS developed in the latter part of the previous week and prices fell sharply on Friday, with professional trading responsible for a greater part of the movement. Prospects of further investigations by the Interstate Commerce Commission aided in the uncertainty of the market and reports of additional suits by the government against the coal roads were factors in the transactions of the week. The depressed condition of the market extended into the earlier part of the present week and at Monday's close prices showed little improvement. Further breaks took place on Tuesday and declines of 2 to 3½ points were made in several issues, while the greatest weakness in the list was shown in the Canadian Pacific group. Several of the subsidiary lines suffered losses of 3 to 5 points and a decline of over 5 points occurred in the stock of the parent company. Active buying was in evidence toward the end of the day's trading and some recoveries were made. The cause of the violent trading in Tuesday's market was not apparent, for most of the general news of the day was of a reassuring nature. Weather and crop reports were favorable and improvement was shown in railroad earnings and in the metal markets. The market, on the whole, is strong in comparison with the condition at the beginning of the summer season, and the various influences affecting it are rapidly adding further strength. News from abroad shows the close of the Morocco incident and crop news is reassuring. Tariff discussions and increase in the number of investigations into corporate affairs are imparting a large percentage of uncertainty to business conditions. With the approach of harvesting many of the Western banks are now drawing on New York correspondents for funds and time-money rates are hardening, while there is a corresponding increase in demand for commercial paper. Rates Aug. 8 were: Call, 2¼@2⅜ per cent; ninety days, 3¼@3½ per cent. The quotations in the tables are those for the close Aug. 8.

NEW YORK.

| | Aug. 1. | Aug. 8. | Shares Sold. | | Aug. 1. | Aug. 8. | Shares Sold. |
|---|---|---|---|---|---|---|---|
| All. Ch..... | 8½* | 6¼* | 2,200 | Int. Met., pt. | 49½ | 45½ | 8,120 |
| All. Ch., pf.. | 28 | 22¾ | 4,300 | Mackay Cos.. | 86 | 85⅛ | 500 |
| Amal. Cop... | 66⅞ | 64¼ | 45,675 | Mackay C.,pf. | 74 | 74½* | 200 |
| Am. D. T.... | 20½* | 20½* | ——— | Man. Elev... | 139* | 137½* | 30 |
| Am. Loco... | 40 | 38 | 1,960 | Met. St. Ry.. | 15* | 15* | ——— |
| Am. Loco.,pf. | 108 | 106* | 100 | N.Y.&N.J.Tel. | 139½ | 139½* | ——— |
| Am. Tel. & C. | 79¾ | 79¾* | 516 | Steel, Com... | 79⅛ | 74⅞ | 519,860 |
| Am. T. & T. | 136⅜ | 135⅞ | 7,000 | Steel, pfd.... | 118 | 116⅞ | 6,234 |
| B. R. T.... | 81 | 76⅞ | 19,750 | W. U. T.... | 79⅝ | 76½ | 8,025 |
| Gen. Elec... | 162¼ | 155 | 7,200 | West'h, com. | 73 | 66 | 8,150 |
| Int. Met.... | 17½ | 16⅞ | 9,800 | West'h, pfd.. | 118¼ | 118¼* | 100 |

PHILADELPHIA.

| | Aug. 1. | Aug. 8. | | Aug. 1. | Aug. 8. |
|---|---|---|---|---|---|
| Am. Rys..... | 44½* | 44½ | Phila. R. T..... | 23¾ | 23½ |
| El. Co. of A..... | 11⅞* | 11⅞ | Phila. Elec..... | 17⅞ | 17¾ |
| Elec. St. Bt'y..... | 55 | 53 | Phila. Trac..... | 86½* | 85½ |
| Elec. St. Bt'y., pf.. | 30* | 30* | Union Trac..... | 52½ | 51⅜ |

CHICAGO.

| | Aug. 1. | Aug. 8. | | Aug. 1. | Aug. 8. |
|---|---|---|---|---|---|
| Chi. City Ry..... | 186* | 186* | Com. Edison..... | 135⅞ | 134 |
| Chi. Elev. Rys..... | 26½ | 26½* | Chi. Subways..... | 3⅝ | 3⅛ |
| Chi. Elev. Rys.... | 93 | 93* | Chi. Tel. Co..... | 123* | 111 |
| Chi. Rs., Ser. 1.... | 100 | 95 | Nat'l Car..... | 113 | 111 |
| Chi. Rs., Ser. 2.... | 32⅞ | 30¾ | Nat'l Car, pfd..... | 118½* | 118½* |

BOSTON.

| | Aug. 1. | Aug. 8. | | Aug. 1. | Aug. 8. |
|---|---|---|---|---|---|
| Am. T. & T..... | 136⅜ | 135 | Mex. Tel..... | 4* | 4* |
| Cum. Tel..... | 157⅝ | 157½* | Mex. Tel., pfd..... | 6* | 6* |
| Edison E. Ill..... | 287 | 286 | N. E. Tel..... | 146 | 148½ |
| Gen. Elec..... | 162½ | 155¼ | W. T. & T..... | 20¼ | 19 |
| Mass. E. Ry..... | 22¼* | 20¾ | W. T. & T., pfd.... | 99* | 99* |
| Mass. E. Ry., pf... | 93 | 92½* | | | |

*Last priced quoted.
Shares sold for the week, July 31 to Aug. 5.

## Financial Notes.

**Progress of Southern California Edison Company.**—John B. Muller, president of the Southern California Edison Company, discussing the industrial growth of Southern California and the extent to which the use of electricity for power purposes now exceeds that for lighting, said recently that since 1904 power business has been gradually gaining on light business, notwithstanding the enormous increase of the latter, which grew 128 per cent during the period from 1904 to 1910. Power won out in the long race during the month of May, showing an earning of $4,771.95 in excess of lighting. In June the same condition obtained, power showing an excess of $28,148.53. During the corresponding months of 1910 the con-

dition was reversed, light exceeding power in May by $2,492.40 and in June $16,337.55. In 1904 power earnings were only 22 per cent of gross electric earnings, while in 1910 they had increased to 47 per cent, passing the 50 per cent mark in May of this year. Exclusive of Los Angeles, electric energy is supplied to something over fifty towns from Santa Barbara County to the verge of the desert in San Bernardino and Riverside Counties. The manufacture of cement has been the largest single industry for which electric power has been used until recently, but now its application to pumping oil wells and for refining purposes is taking first place, while the agricultural phase of the power consumption is almost as important as the manufacturing feature in the territory served by the company.

**Earnings of New York Edison Company.**—In the six months ended June 30, 1911, the gain in business by the New York Edison Company was in excess of that for the same period in 1910, and, from present indications, the rate of increase will be continued until the close of the year. As a consequence of the reduction in rates on July 1, resulting in a loss of some $625,000 to the company for the second half of the year, the gross returns will not reflect the actual increase in business secured. Estimates, based on the past six months, place the earnings for the year at the rate of 12.6 per cent on the stock of the company, and distribute the various items as follows: Gross earnings, $19,000,000; operating expenses, $9,250,000; taxes, $1,200,000; uncollected, $100,000; operating income, $7,850,000; non-operating income, $1,15,000; gross income, $9,000,000; deductions from income, $2,700,000; surplus available for dividends, $6,300,000. It is expected, in spite of the probability of this amount available, that the rate of dividends will not be changed from 6 per cent for 1911. In case the rate is unchanged, only half of the surplus will be required, leaving close to $3,000,000, if the estimate is correct, for addition to the previous surplus.

**Statement of American Telephone & Telegraph Company.**—The general balance sheet of the American Telephone & Telegraph Company as of June 30, 1911, as reported to the New York Stock Exchange, gives assets as follows: Construction, equipment and supplies, $46,556,279; telephone instruments, $12,131,515; real estate, $2,188,239; stocks and bonds, $359,867,657; treasury bonds, $5,000,000; loans to telephone companies, $27,522,229; special demand notes, $27,898,262; cash and deposits, $26,994,964; accounts receivable, $7,931,074; total, $516,090,223. Liabilities: Capital stock, $275,432,300; collateral trust bonds, $78,000,000; convertible bonds, $22,734,000; coupon notes, $15,000; accrued interest, $1,960,518; taxes, $176,105; unearned revenue, $2,933; notes payable to Western Union Telegraph Company, due 1912-1915, $16,500,000; notes payable to subsidiary companies, $17,405,000; other accounts payable, $6,403,303; reserve for depreciation, $38,505,014; surplus, $56,190,783; revenue balance, $2,765,263; total, $516,090,223.

**Superior (Wis.) Water, Light & Power Bonds.**—Redmond & Co., of New York, are offering first mortgage 4 per cent sinking-fund gold bonds of the Superior (Wis.) Water, Light & Power Company at 84½ and interest, paying about 5.25 per cent. The authorized issue is $2,000,000, of which $1,600,000 is outstanding. The bonds are due May 1, 1931, and are callable on any interest date at 103 and interest, and are secured by a first mortgage on the entire property of the company. Net earnings for the past twenty-one years have averaged one and one-half times the present interest on these bonds, and for the year ended June 30, 1911, amounted to about two and one-half times this sum. The franchises are virtually perpetual, subject to the right of the city to purchase the property on terms which adequately safeguard the company's interest.

**Trinidad (Col.) Central Station Company Sold.**—The holdings of the Colorado Railway, Light & Power Company of Trinidad, Col., were sold at a receiver's sale on Aug. 2 to the Federal Light & Traction Company of New York. It is expected that a company, to be known as the Trinidad Electric Transmission Railway & Gas Company, will be organized by the purchasers, to take its place. The Colorado Railway Company failed about a year ago, and was reorganized with $5,000,000 capital stock and $5,000,000 first-mortgage, 5 per cent bonds, of which $1,998,000 have been issued. The company now serves some sixteen coal mines at Trinidad, which contain the only large deposit of coking coal west of the Mississippi.

**Pacific Gas & Electric Company.**—Gross earnings of the Pacific Gas & Electric Company, which is to add 71,000 hp to the capacity of its stations, as reported in a recent issue of the *Electrical World*, have increased at a rate of nearly $1,000,000 per year in the last five years. Gross revenue in 1906 was $8,947,162 and net revenue was $4,524,043, while the corresponding items for 1910 were $14,229,228 and $5,938,623 respectively. Expenditures for improvements, betterments, etc., in the past seven years aggregate more than $16,450,000, of which $5,000,000 has been secured from surplus earnings. It is stated that the present replacement value of the properties is between $68,500,000 and $70,000,000, which, it is said, is almost double the total outstanding bonded debt of the company.

**Earnings of Twin City Company.**—Business of the Twin City Rapid Transit Company increased each month in the past six months ended June 30, and the totals for the period show nearly $200,000 in excess of the gross earnings of the previous year. The earnings for the month of June, which showed the largest increase, were 4.67 per cent greater than those in June, 1910. Operating expenses also increased in the six months, but only in the month of April did they overbalance the gain in gross earnings. Such increases in cost of operation as were caused by shortage of power due to low water in the Mississippi have been reduced to the normal. From present indications the earnings for the year will be the largest in the history of the company.

**Federal Telephone Company (New York) Files Mortgage.**—The final step in the consolidation of the independent telephone companies in western New York was taken during the week, when the Federal Telephone & Telegraph Company gave a mortgage of $25,000,000 upon its properties in ten counties of western New York State to the Trust Company of America.

**Continental Motor Manufacturing Company.**—The Continental Motor Manufacturing Company, Muskegon, Mich., will erect a large manufacturing plant in Detroit, Mich., including eight large buildings and a power house of 1000-kw capacity. Harry C. Spellman, 505 Ford Building, Detroit, is construction engineer for the company.

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### DIVIDENDS.

Federal Light & Traction Company, quarterly, preferred, 1½ per cent, payable Sept. 1.

Federal Utilities, Inc., initial, quarterly, preferred, 1½ per cent, payable Sept. 1.

Kings County Electric Light & Power Company, quarterly, 2 per cent, payable Sept. 1.

Pacific Gas & Electric Company, quarterly, $1.50 per share, payable Aug. 15.

Portland Railway, Light & Power Company, preferred, $1 per share, payable Sept. 1.

### REPORTS OF EARNINGS.

AMERICAN LIGHT & TRACTION COMPANY.

| Period. | | | Gross Earnings. | Operating Expenses. | Net Earnings. | Fixed Charges. | Net Surplus. |
|---|---|---|---|---|---|---|---|
| 12m., | June, | '11 | $4,042,831 | $117,957 | $3,924,874 | ..... | ..... |
| 12 " | " | '10 | 3,598,492 | 110,151 | 3,488,341 | ..... | ..... |

BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.

| | | | | | | |
|---|---|---|---|---|---|---|
| June, | 1911 | $85,282 | $41,344 | $43,938 | $30,038 | $13,900 |
| " | 1910 | 78,079 | 41,472 | 39,607 | 29,291 | 10,316 |

COLUMBUS ELECTRIC COMPANY.

| | | | | | | |
|---|---|---|---|---|---|---|
| June, | 1911 | $39,554 | $18,732 | $20,822 | $10,675 | $10,147 |
| " | 1910 | 37,294 | 17,859 | 19,435 | 17,615 | 1,820 |

DALLAS ELECTRIC CORPORATION.

| | | | | | | |
|---|---|---|---|---|---|---|
| June, | 1911 | $122,110 | $85,962 | $36,148 | $27,287 | $8,861 |
| " | 1910 | 114,514 | 81,445 | 33,069 | 26,605 | 6,464 |

EL PASO ELECTRIC COMPANY.

| | | | | | | |
|---|---|---|---|---|---|---|
| June, | 1911 | $52,470 | $31,624 | $20,846 | $8,336 | $12,510 |
| " | 1910 | 45,224 | 27,409 | 17,815 | 8,195 | 9,620 |

GALVESTON-HOUSTON ELECTRIC COMPANY.

| | | | | | | |
|---|---|---|---|---|---|---|
| June, | 1911 | $134,934 | $77,537 | $57,397 | $25,074 | $32,323 |
| " | 1910 | 109,083 | 67,027 | 42,056 | 17,729 | 24,327 |

KEYSTONE TELEPHONE COMPANY.

| | | | | | | |
|---|---|---|---|---|---|---|
| 12m., | June, '11 | $1,153,788 | $572,004 | $581,784 | $293,383 | $288,401 |
| 12 " | " '10 | 1,126,030 | 558,079 | 567,951 | 302,755 | 265,196 |

MINNEAPOLIS GENERAL ELECTRIC COMPANY.

| | | | | | | |
|---|---|---|---|---|---|---|
| June, | 1911 | $108,316 | $44,717 | $63,599 | $38,262 | $25,337 |
| " | 1910 | 93,050 | 38,475 | 54,575 | 30,725 | 23,850 |

NORTHERN TEXAS ELECTRIC COMPANY.

| | | | | | | |
|---|---|---|---|---|---|---|
| June, | 1911 | $136,061 | $68,285 | $67,786 | $25,244 | $42,542 |
| " | 1910 | 120,964 | 64,701 | 56,263 | 20,162 | 36,101 |

SAVANNAH ELECTRIC COMPANY.

| | | | | | | |
|---|---|---|---|---|---|---|
| June, | 1911 | $59,927 | $41,565 | $18,362 | $18,622 | $10 |
| " | 1910 | 53,610 | 35,596 | 18,014 | 18,008 | 6 |

SEATTLE ELECTRIC COMPANY.

| | | | | | | |
|---|---|---|---|---|---|---|
| June | 1911 | $433,701 | $242,969 | $190,732 | $114,347 | $75,385 |
| " | 1910 | 447,676 | 261,337 | 186,339 | 119,695 | 76,634 |

TWIN CITY RAPID TRANSIT COMPANY.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6m., | June, | '11 | $3,781,952 | $1,928,794 | $1,853,158 | $840,475 | $1,012,683 |
| 6 " | " | '10 | 3,582,248 | 1,748,128 | 1,834,119 | 841,141 | 992,978 |

# General News

## Construction News.

BLUE MOUNTAIN CITY, ALA.—The installation of an electric-light system in Blue Mountain City is reported to be under consideration. H. F. Williamson is Mayor. Post office address is Anniston, Ala.

MONTGOMERY, ALA.—The advisability of placing all overhead wires in conduits is to be considered at a conference of the Board of City Commissioners and representatives of the Montgomery Light & Water Power Company, the Montgomery Traction Company, the Citizens' Light, Heat & Power Company and the Western Union and Postal Telegraph companies.

PHOENIX, ARIZ.—A petition has been submitted to the City Council by the citizens of Phoenix requesting that an ordinance be passed requiring the Pacific Gas & Electric Company to place its wires in conduits.

PHOENIX, ARIZ.—The Salt River Electric Company, recently organized, is planning to build an electric railway system in Salt River Valley, involving an expenditure of about $600,000. Work will soon begin on construction of the proposed railway and about 50 miles will be completed within a year. It is proposed to build one line from Phoenix to Peoria, 15 miles in length, another from Phoenix to Scottsdale, a distance of 11 miles, and also a branch to Mesa, 18 miles southeast. A spur will extend to a point 3½ miles east of the city, where it is proposed to establish a large amusement park.

HELENA, ARK.—Contracts have been awarded by the Schofield Engineering Company, of Philadelphia, Pa., which recently purchased the local electric and gas plants, for the construction of a new electric power house to T. P. Reynolds, of Memphis, Tenn. This is a beginning of extensive improvements to be made to both the gas and electric systems in this city.

ANAHEIM, CAL.—The installation of an ornamental street-lighting system on Center and Los Angeles Streets is under consideration. It is proposed to replace the present arc lamps with cluster lamps.

DORRIS, CAL.—Bids will be received by Fred Chapman, town clerk, until Aug. 25 for the construction of water-works system, in accordance with plans and specifications now on file at the office of the town clerk as follows: 1—Construction of system complete with machinery for gasoline power. 2—To construct system complete with equipment for electric power (electricity to be supplied by the Siskiyou Light & Power Company). The above does not include the digging or construction of the well, for which a separate bid must be submitted. Copies of plans and specifications may be obtained upon application to the town clerk, for which a charge of $5 will be made.

EL CENTRO, CAL.—The City Councilmen are discussing the installation of an electric pumping system for the city's water supply. Energy will be taken from the Holton Power Company's system.

HOLTVILLE, CAL.—The Holton Power Company is to increase its capital stock from $500,000 to $1,000,000, the proceeds to be utilized in providing for present and future extensions of the company's electric-lighting and ice plants in the Imperial Valley.

INGLEWOOD, CAL.—The town of Inglewood has entered into a contract with the Southern California Edison Company, of Los Angeles, for street lighting. At present only improved streets will be lighted. Later the service will be extended throughout the entire town. Arc lamps will be installed.

KENNETT, CAL.—The Board of Trustees of Kennett has granted the Sacramento Valley Power Company a franchise to erect transmission lines on the streets and highways of the city for a term of fifty years for the distribution of electricity for lamps and motors.

LONG BEACH, CAL.—Investigations are being made by the city officials with a view of installing electrical machinery in the municipal water plant to generate electricity to light the streets and public buildings. The city now expends about $28,000 yearly for lighting the city. To carry out present plans would necessitate the purchase of the street-lighting system of the Edison company or the erection of new lines.

LOS ANGELES, CAL.—The contract for installing six traction passenger, one electric drum freight, one electric automatic and two hydropneumatic sidewalk elevators in the new eleven-story building being erected at Seventh and Springs Street, Los Angeles, by the Van Nuys Building Company, has been awarded to the Otis Elevator Company, for $48,345.

PALMS, CAL.—The installation of an electric street-lighting system in Palms is reported to be under sonsideration.

PALO ALTO, CAL.—An appropriation of $2,300 has been made by the City Council for the extension of the municipal lighting system to South Palo Alto, and work on the construction of the transmission line is to be commenced at once under the supervision of City Electrician Youens.

RIVERSIDE, CAL.—The Southern Sierras Power Company has awarded contract for the construction of a steam-power plant to be erected near San Bernardino. The proposed plant will have an output of 5000 kw.

SACRAMENTO, CAL.—The name of the Citizens' Light & Power Company has been changed to the Citizens' Electric Company, and articles of incorporation are to be filed at once.

SAN BERNARDINO, CAL.—It is announced that F. A. Worthley has secured the franchise for which he recently applied in this city, and has turned it over to the Southern Sierras Power Company, which company, it is understood, he represents, and not the California-Nevada Power Company, as previously stated.

SAN DIEGO, CAL.—The work of installing its wires in conduits has been commenced by the San Diego Consolidated Gas & Electric Company, an ordinance having recently been passed requiring the overhead wires of all electric companies, with the exception of the San Diego Electric Railroad, to be placed underground.

SAN FRANCISCO, CAL.—The Board of Public Works has adopted a resolution calling on the Supervisors to sell $400,000 addditional Geary Street railway bonds to provide funds for construction of power house and car barns.

SAN JOSE, CAL.—It is understood that the Great Western Power Company, which operates a 55,000-hp plant at Big Bend, on the Feather River, is preparing to enter the electric lighting field at San Jose in competition with the Union Gas & Electric Company. It is stated by Mr. J. H. Hornung commercial representative, that if sufficient business can be assured to warrant the extension of the company's lines to that city work will be undertaken at an early date.

WATTS, CAL.—The Pacific Light & Power Company has submitted to the Chamber of Commerce the following proposition for lighting the city: It agrees to erect poles, string wires and install forty-five tungsten lamps for the sum of $9,000, the city to pay a flat rate of $68 per month for the electricity used for a period of five years and, in addition to the above rate, to pay $150 per month for five years for installing the plant, making a total of $218 per month for five years.

FRUITA, COL.—The Grand Junction & Grand River Railway Company, Grand Junction, Col., has been granted a franchise by the City Council of Fruita for the sale of electricity in that city. The Council has also signed a twenty-five-year contract with the company for a street-lighting system.

OAK CREEK, COL.—Work has commenced on the installation of an electric-light plant in Oak Creek under a franchise granted to John Sharpe, of Cripple Creek, president of the Oak Creek Town Land & Mining Company. Orders have been placed for a 2200-volt, alternating-current generator and 3 miles of wire will be erected at once.

TRINIDAD, COL.—The Colorado Railway, Light & Power Company, Trinidad, Col., which was reorganized about a year ago with a capitalization of $5,000,000, was sold to the Federal Light & Traction Company, of New York, on Aug. 2, the price being $950,000. The property was bid in at a receiver's sale by C. C. Chapelle, of New York City. It is announced that many important extensions will be made in the near future to the plant and business of the company.

GUILFORD, CONN.—The Borough Council is considering the question of lighting the streets of the borough by electricity. The Housatonic Power Company has submitted a proposition offering to install 100 incandescent lamps of 25 cp at $13.50 each per year, making the total cost per year $1,150, against $540 for maintenance of the present oil lamps. It is proposed to enter into a three-year contract, the company to bear the expense of installation of the system.

NEW MILFORD, CONN.—Application for a charter has been filed by the Still River Power Company, of this city. It is understood that the granting of such a charter is being opposed by the New Milford Electric Light Company.

NEW MILFORD, CONN.—Plans for the construction of a dam below the gorge, at which point electrical energy for its own use and for public distribution can be generated, are being considered by the Silica Paint Company, of this city.

NORWICH, CONN.—The municipal electric light plant, which is at present installing a new turbine generator and condenser, is planning to extend its transmission line a mile south of Thamesville in order to supply electricity for lighting the Norwich Golf Club and such other residences along the route as may care to take advantage of the service.

OCCUM, R. D., VERSAILLES, CONN.—Arrangements are being made by the Totakett Company to install an electric-light plant to supply electricity to light the mill, tenements and residences in the town. A generator with sufficient output to supply 1000 lamps will be installed. The contract for the work has been awarded to the Norwich Electric Company, of Norwich, Conn.

WASHINGTON, D. C.—Consular Report No. 182 states, under Foreign Trade Opportunities, Item 7139, that a hotel proprietor in Syria

wishes estimates for installing a small electric passenger elevator in his hotel. Correspondence should be in English.

WASHINGTON, D. C.—The contract for furnishing eight 5000-lb. and four 10,000-lb. electric motor trucks for the Bureau of Yards and Docks, Navy Department, Washington, D. C., has been awarded to the General Vehicle Company, Long Island City, L. I., N. Y., for $49,000.

WASHINGTON, D. C.—Consular Report No. 183 states, under South African Notes, that the Durban borough electrical engineer has been employed to purchase specimens of suitable and up-to-date electrical appliances for household use, with the object of bringing them to the notice of consumers.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Sept. 15 for the installation of an electric elevator plant in the United States post office at Washington, D. C., in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of D. H. Burnham & Company, of Chicago, architects. James Knox Taylor is supervising architect.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Sept. 15 for mechanical equipment, excepting elevators and mail-handling apparatus, including plumbing, gas fitting, boiler plant, heating and ventilating system, conduit and wiring system, vacuum-cleaning system and induced-draft system for the United States post office building, Washington, D. C., in accordance with drawings and specifications, copies of which may be secured at the above office or at the office of D. H. Burnham & Company, of Chicago, Ill., architects. James Knox Taylor is supervising architect.

ST. AUGUSTINE, FLA.—The St. Johns Light & Power Company has been placed in the hands of a receiver, B. E. Dyson, of St. Augustine. It is understood that the embarrassment of the company is merely temporary and that it will be operated under the receivership for a brief time only. The reason assigned for the default of interest on bonds, which led to the above action, is the fact that the company's surplus earnings have been utilized for extensions and improvements. Receiver Dyson states that neither the electric-light nor trolley service will suffer impairment under the present arrangement.

SOUTH JACKSONVILLE, FLA.—Sealed proposals will be received by the Board of Bond Trustees of the city of South Jacksonville, Fla., until Aug. 24 for furnishing material and construction of electric-light plant and water-works system as follows: For furnishing approximately 5 miles 8-in., 6-in. and 4-in. cast-iron pipe and specials; hydrants and valves; drilling 12-in. well; furnishing tower and tank; two boilers; feed-water heater; pumps; generator, exciter, swichboard, etc.; simple valve engine; laying cast-iron pipe; constructing reservoir, tower foundations; installing machinery; furnishing and erecting electric transmission lines, and construction of power house. Plans may be seen at the office of William W. Lyon, 305 Duval Building, Jacksonville, consulting engineer, where copies of specification may be obtained upon application. W. W. Swaim is chairman Board of Bond Trustees.

AUGUSTA, GA.—Arrangements are being made to begin work on the construction of the dam of the Twin City Power Company on the Savannah River, about 30 miles above Augusta. The proposed plant will cost about $1,000,000 and will supply electricity in this section of Georgia and in South Carolina. The company has filed a petition with the City Council of Savannah, Ga., asking for a franchise to supply electricity in that city. Thomas O'Conner, of New York, N. Y., is interested in the project.

COLUMBUS, GA.—The Georgia Power Company has applied to the City Council for a franchise to construct and operate an electric plant in Columbus.

COLUMBUS, GA.—The contract for the completion of the large dam in course of construction by the Stone & Webster Engineering Corporation, of Boston, Mass., across the Chattahoochee River, north of Columbus, has been awarded to the B. H. Hathaway Company, of Columbus. The original plans called for the erection of a 26-ft. dam, which was started last year. The second contract, recently awarded, calls for an additional 44 ft., making a 76-ft. dam, which, when completed, together with power plant will involve an expenditure of about $1,500,000. The plant when completed will supply electricity in West Point, La Grange, Opelika, Newnan and other towns and cities in that section.

SALMON CITY, IDAHO.—The control of the Andrews Light & Power Company has passed into the hands of Pomeroy (Wash.) capitalists, the consideration being $76,000. The officers of the company, which will hereafter be known as the Lemhi Power Company, are: C. L. Mackenzie, president; E. Riggs, vice-president and manager, and Ralph Irvin, secretary.

CHICAGO, ILL.—Plans are being considered by the Chicago Suburban Edison Company, which recently absorbed the Economy Light & Power Company, of Joliet, Ill.; the North Shore Electric Company, of Chicago, Ill.; the Illinois Valley Gas & Electric Company, of Streator Ill., and the Kankakee Gas & Electric Company, of Kankakee, Ill., to construct two or three generating plants to supply electric service to sixty-five cities and villages more economically than at present. It is proposed to utilize the water rights owned by the Economy Light & Power Company.

FT. SHERIDAN, ILL.—Contracts for constructing a central heating and power plant at Ft. Sheridan, Ill., have been awarded as follows: To Nilson Brothers, of Chicago, Ill., for removing boilers and installing new boilers, at $17,000; Heine Chimney Company, for stack, at $3,900, and to the Western Electric Company for other machinery, at $4,840.

MASCOUTAH, ILL.—For some time the citizens of this city have had under consideration the purchase of the plant of the Mascoutah Electric Light Company. An alternative proposition has been the installation of a new plant. To carry out either of the above plans a special election is to be held to vote on a $12,000 bond issue.

MINONK, ILL.—The Minonk Electric Light & Power Company, Minonk, Ill., has been dissolved.

BLOOMINGTON, IND.—Efforts are being made by F. Reibel, general manager of the Southern Indiana Power Company, Indianapolis, to induce the quarrymen of Bloomington to run their plants by electricity. If he is successful, it is the intention of the company, which has its main plant at Williams, to expend $50,000 for the construction of a transmission line from Stinesville to Bloomington. The Consolidated Stone Company has installed a temporary plant, to be used only until the Southern Indiana Company gets its system in operation.

CLINTON, IND.—The capital stock of the Clinton Electric Light & Power Company has been increased from $10,000 to $40,000. The company proposes to make extensive improvements in its plant. David McBeth is president of the company and J. W. Robb, secretary.

ELKHART, IND.—It is stated that the Indiana & Michigan Electric Company proposes to expend in the neighborhood of $500,000 on contemplated improvements.

INDIANAPOLIS, IND.—The Board of Public Works has ordered the wires of all public service corporations in the mile square to be placed in conduits. This also applies to the high-voltage wires of the trolley companies.

INDIANAPOLIS, IND.—The W. H. Schott Company, of Chicago, Ill., has been admitted to do business in Indiana. The company is capitalized at $300,000 and proposes to make a specialty of designing and constructing electric plants, central heating plants, industrial heating plants and overhead and underground electrical construction work. J. W. Fesler, 725 Newton Claypool Building, Indianapolis, Ind., is the State representative.

JASPER, IND.—Bids will be received at the electric light office in Jasper, up to 7:30 p. m., Aug. 21, by the board of trustees, for the construction of an addition to the electric-lighting system, according to plans and specifications prepared by Architect M. F. Durlauf, and which are on file with the town clerk.

KENDALLVILLE, IND.—The City Council has awarded the contract for ornamental lamp standards for the boulevard lighting system, to be installed in the business district, to the Western Gas Construction Company, of Ft. Wayne, Ind. From forty to sixty posts, to cost $42.80 each, will be used.

LAWRENCEBURG, IND.—The construction of an electric railway between Osgood and Versailles is planned, nearly all of the right-of-way privileges having been obtained along the proposed route. Those interested in the proposition are J. L. Phillips, Clinton, Mo., and Julius E. Wayland, Gerard, Kan.

MARION, IND.—A new electric-light plant is to be installed in this city to take the place of the one destroyed by fire some time ago, the contract for the construction of a new building having been awarded by the City Council to J. H. Waldron. Two new electrically driven pumps will be substituted for the steam pumps formerly in service.

NOBLESVILLE, IND.—An order for the sale of the White River Light & Power Company on Aug. 15, at the office of the Wainwright Trust Company, of Noblesville, has been issued by the United States referee, the concern having passed into the hands of a receiver and thence into the Bankrupt Court. An upset price of $30,000 has been placed by the referee, and the requirement made that the successful bidder shall deposit $5,000 in a certified check or cash with his bid, the balance of the purchase money to be paid within fifteen days. About $150,000 has been expended by the White River Company on its hydro-electric development on the White River, and it is estimated that about $75,000 will be required to complete the plant. The company owns seventy-five acres of land in fee. 160 ft. of concrete dam has been built and the turbine chambers are partially completed. The plant is equipped with 406 hp in boilers, a 300-kw turbo-generator set and condensing apparatus, all of modern make and in good condition. Transmission lines are built to Noblesville, a distance of two miles, and a distribution system covers the city.

PRINCETON, IND.—Plans are being prepared by the City Council for the installation of cluster lamps around the public square and in the principal business street.

SHIRLEY, IND.—An electric-light system is being installed on Main Street by the local business men. Electricity for maintaining the lamps will be supplied by the Indianapolis, New Castle & Toledo Traction Company.

CLARION, IOWA.—The electric-light plant at this city, owned by Carr & Mozingo, has been destroyed by fire.

INDEPENDENCE, IA.—The contract for new equipment for the electric plant is reported to have been awarded to the Allis-Chalmers Company, Milwaukee, Wis., the price being $11,000.

KEOKUK, IA.—It is reported that Sargeant & Lundy, Chicago, have transferred to the Stone & Webster Construction Company, of Boston, the public utilities of Keokuk, including the electric light and gas plants, street railway system and the Keokuk & Warsaw Interurban Line, the consideration, however, not being made public. Lighting and street railway franchises in Keokuk were recently granted to Stone & Webster, and it is understood that several hundred thousand dollars will be expended in the extension and improvement of the public utility plants thus acquired. A. D. Ayers, who has been local manager for the Chicago interests, will be retained in that capacity by the new owners.

NEWTON, IA.—The contract for the construction of the municipal plant at this city has been awarded to Eastmine & Stines, of Newton, for $13,700.

GARDEN CITY, KAN.—The advisability of authorizing a $40,000 bond issue, the proceeds to be utilized for the installation of a municipal electric-light plant, is being considered by the citizens of Garden City.

GREENSBURG, KAN.—Contracts have been awarded by the City Council for equipment for the proposed municipal electric-light plant. The electrical equipment will be furnished by the United Electrical Company, of Wichita, Kan., and the Sheffield Gas Power Company, of Kansas City, Mo., will supply two 50-hp solar oil engines. J. W. Rigby, of Wichita, Kan., has been engaged as electrical engineer.

MANHATTAN, KAN.—The Manhattan Interurban Railway Company is planning to construct an electric railway from Manhattan to Ft. Riley, at which point it will connect with the line running between Ft. Riley and Junction City, making a continuous line from Manhattan to Junction City, a distance of 24 miles.

NEODESHA, KAN.—At a meeting of the city commissioners the new electric lighting plant, for which the city voted $12,000 in bonds, was accepted, and it is now the property of the city.

COVINGTON, KY.—The Covington Industrial Club has petitioned the Board of Aldermen to install an ornamental street-lighting system on Madison Avenue and Pike Street. Efforts are being made to have cluster lamps erected on the main thoroughfares in the city.

LOUISVILLE, KY.—Arrangements have been completed by the Kentucky Electric Company to take over the contract for lighting the Galt House. It was first proposed to rebuild the electric plant in the hotel, which would have cost $65,000 and $24,000 a year to maintain. The stockholders decided to abandon the private plant and contract with the Kentucky Electric Company for electrical service.

LOUISVILLE, KY.—Permission has been granted to the Federal Sign System by the Board of Public Works to erect boulevard lamps on Jefferson Street, between Second and Third Streets, and between Third and Fourth Streets, electricity for the former to be supplied by the Kentucky Electric Company and for the latter by the Louisville Lighting Company. The lamps, which are to be mounted on standards in clusters of five lamps to the standard, are to be erected without expense to the city and removed should the installation be passed upon unfavorably by the board. On the other hand, should the lighting system prove satisfactory, permission will be sought by the Federal Sign Company to install similar standards along various other business streets of the city, the expense to be borne by the merchants benefited.

RANGELEY, MAINE.—The building, boilers and engine which have been used at the electric-light plant at this city, together with the land on which the plant is located, have been purchased by William Tomlinson from the Kempton Lumber Company. Mr. Tomlinson has also leased the generator, electric-light poles and wires of Mr. Benson, of Lewiston, with the privilege of buying them, and will operate the plant.

RICHMOND, MAINE.—The Board of Selectmen has entered into a contract with the Central Maine Power Company for lighting the streets of the town with electricity. The company will soon begin work on the erection of the transmission line from Gardiner to Richmond. The contract is for a period of ten years and provides for seventy-one 25-cp incandescent lamps.

BALTIMORE, MD.—Orders have been placed by the Baltimore & Ohio Railroad Company with the United States Electric Company for forty complete telephone station equipments for the extension of its telephone train-dispatching service from Clarksburg to Salem.

CONCORD, MASS.—The Municipal Light Board has decided to reduce the rate for electricity for commercial and domestic lighting from 10 cents to 9 cents per kw-hour; no change will be made in the price for cooking and heating purposes, which is 4 cents per kw-hour; for lighting the municipal buildings the rate is 6 cents per kw-hour. Renewals are furnished of all gem lamps free of charge and of carbon lamps up to 8 cp. An appropriation is made by the town of $5,000 for the street-lighting system, which consists of 940 incandescent lamps, operated 3200 hours. A. W. Lee is manager of the municipal electric-light plant.

FALL RIVER, MASS.—The officers of the Bradford Durfee Textile School have been notified that the Legislature has appropriated $53,000 for the school, which is now available. Of this sum $27,000 is to be used for running expenses and $27,000 for erection of an addition to the school, the construction of power house and new equipment, establishing a new designing department and purchase of additional equipment for the engineering, electrical and weaving departments.

FRANKLIN, MASS.—It is the intention of C. D. Parker & Company, who recently took over the plant and holdings of the Union Electric Light Company, of Franklin, as well as the property of the Foxboro Electric Company, to construct a transmission line from Franklin to Foxboro and to discontinue the steam plant which is at present in operation at the latter city.

GRANBY, MASS.—The South Hadley Falls Electric Company is making investigations with a view of extending its transmission lines to Granby. The company is ready to extend its system if sufficient business is guaranteed.

LEE, MASS.—It is stated that Carl Wurtzbach and Alex. G. Uptegraff, of Lee, are interested in a plan to increase the equipment of the Lee electric plant, to secure energy from the Monument Mills Company and to furnish service for Lee and Lenox and some of the large country estates. The present plans call for the building of a 6000-volt transmission line.

MILLBURY, MASS.—The contract for the new substation of the Worcester Suburban Electric Company, on Grafton Street, has been awarded to E. D. Ward, of Worcester, and work will be commenced at an early date. It is stated that the new station, which will cost in the neighborhood of $5,000, is to be supplied with modern equipment. The generating station of the company, which has recently contracted with the town of Auburn to furnish electricity for lighting the streets, is located at Uxbridge, and energy will be transmitted from that point to Millbury.

SHELBURNE FALLS, MASS.—It is expected that work on the concrete dam to be built by the Chase and Harriman interests, which is to replace the wooden structure which now furnishes hydroelectric energy to the Lamson & Goodnow Manufacturing Company at Shelburne Falls, will be commenced in a few days. During the process of construction energy for operating the Lamson & Goodnow plant will be transmitted from the large power station near Brattleboro, Vt.

UXBRIDGE, MASS.—The Worcester Suburban Electric Company expects to install in the new addition which is being made to its plant on Depot Street one 2000-hp steam turbine and two 400-hp Edge Moor boilers.

WORCESTER, MASS.—A. S. Lowell, president of the A. S. Lowell Company, has purchased the property of the A. S. Lowell Company and hereafter the concern will be operated by him. The reason for the change was the refusal of the Massachusetts Gas and Electric Light Commission to approve the franchise which the Board of Aldermen granted Mr. Lowell to lay a conduit across Foster Street from the Lowell Building, in which he has a private electric plant, to light the Lowell store at the corner of Main and Foster Streets. The claim was made that the party owning the electric plant and the store was not the same party; the Worcester Electric Light Company claimed that the approval of the contract would mean the approval of a second concern to sell electricity in Worcester, which the commission upheld. Mr. Lowell proposes to apply to the commission for another franchise.

BARAGA, MICH.—The Oscar Claussen Engineering Company, St. Paul, Minn., has been selected as consulting engineer in connection with the installation of water works and electric-light plant at Baraga.

DETROIT, MICH.—The Consolidated Light & Power Company, which is capitalized at $100,000, the land value of the property held by the company, has been organized in Michigan for the purpose of erecting and operating hydroelectric plants on the Chippewa River. Energy will be generated and distributed to about thirty towns, among them Midland, Ionia, St. Johns, Ithaca and Mount Pleasant. The company now has two dams across the Chippewa River, and contemplates the construction of seven more. The officers, all Detroit men, are: President, J. L. Hudson; vice-president and general manager, Charles S. Abbott; secretary, Robert Tannerhill; treasurer, F. R. Ross.

SAGINAW, MICH.—Judge Angel, of the United States District Court of Eastern Michigan, on July 27 handed down a decision making the injunction permanent which the Saginaw Power Company secured against the city of Saginaw, restraining the Board of Public Works from removing its poles, wires, conduits, etc., from the steets after the Bartlett Illuminating Company's franchise was declared forfeited last August. Owing to the failure of the city and the Bartlett Illuminating Company to reach an agreement for an adjustment of rates, and the announcement that the Saginaw Power Company had purchased the physical properties of the Bartlett company and would do business in Saginaw under the Eastern Michigan Power Company's franchise, the City Council adopted a resolution calling for the removal of poles, etc., and the injunction in the United States Court followed. There is pending in the Circuit Court of Saginaw County a case of the people against the Bartlett Illuminating Company, the Saginaw Power Company and the Eastern Michigan Power Company to dissolve the corporation on the ground that it is a monopoly.

ALBERT LEA, MINN.—It is reported that the Northwestern Telephone Exchange Company will expend about $10,000 in placing its wires in conduits.

LITTLE FALLS, MINN.—A fire at the plant of the Little Falls Water Power Company, due to a short circuit on the switchboard, caused several thousand dollars damage. The switchboard was entirely destroyed, and considerable damage done to two 500-kw generators. A small generator is now furnishing electricity to light the city.

MAYNARD, MINN.—There is a movement on foot in this city looking toward the installation of a municipal electric-light plant.

BRANSON, MO.—Surveys are being made for locating the site for the White River dam. It is proposed to locate the proposed dam and erect a hydroelectric plant about 5 miles from Branson. Electricity generated at the plant will be transmitted to Springfield, a distance of 35 miles. M. L. Holman and John A. Laird are making preliminary surveys.

ST. LOUIS, MO.—It is reported that bids will be received by the Board of Public Improvements, William T. Findly, secretary, 300 New City Hall, until 12 noon, Aug. 15, for furnishing and erecting electric and gas-lighting fixtures in the Municipal Court Building.

ST. LOUIS, MO.—Preparations are being made for the construction of a power house in West Walnut Manor. The proposed plant will be located on land contiguous to the Wabash Railroad tracks and will supply electricity in West Walnut Manor and also to operate the proposed street car line which is to connect the new subdivision with the Bellefontaine and the Union Avenue car lines at Walnut Park.

BUTTE, MONT.—The Butte, Anaconda & Pacific Railway Company, it is said, has decided to discard steam power and equip its railway for electrical operation, which will involve an expenditure of about $1,000,000.

GLASGOW, MONT.—The city of Glasgow is contemplating the installation of an ornamental street-lighting system and would like to receive prices on lamp-posts, gviving weights, cuts and equipment. E. S. Severance is city engineer.

HELENA, MONT.—Steps have been taken by the City Council for the installation of a system of cluster lamps on all streets in the business district of the city.

BURLINGTON, N. J.—A special election for the purpose of voting on the installation of a municipal electric-light system has been called for Sept. 6. The alleged high rates and poor service since the plant passed under the control of the Public Service Corporation is stated to have precipitated this action.

MONTCLAIR, N. J.—Negotiations are under way between the Town Council and the Public Service Corporation for lighting the streets of the town by electricity.

BROOKLYN, N. Y.—The contract for installing electric equipment in Public School 168, located on Throop Avenue, between Bartlett and Whipple Streets, Brooklyn, N. Y., has been awarded to T. Frederick Jackson, Inc., New York, N. Y., for $9,845.

BUFFALO, N. Y.—The Sisters of Mercy, 1475 Abbott Road, Buffalo, N. Y., have awarded the contract for construction of power plant for the Mother House of the order at Abbott Road and Red Jacket Parkway to Mosier & Summers, 1266 Seneca Street, Buffalo, N. Y., to cost $10,000.

CATSKILL, N. Y.—Because of alleged dissatisfaction as regards both the service rendered and the rates charged, it is stated that the citizens of Catskill are considering the installation of a municipal electric-light plant.

DOLGEVILLE, N. Y.—The P. B. McCaghey Company, of Little Falls, N. Y., has secured the contracts for replacing wooden dams in Dolgeville and Newport with concrete structures. The dam in Newport will be 9 ft. in height and will supply power to operate the electric-light and power plant and other industries in that district. The dam in Dolgeville is owned by the American Felt Company and will be 7 ft. high.

HARTWICK, N. Y.—Permission has been granted by the Public Service Commission to the Hartwick Power Company to erect poles and string wires in the lighting district of Hartwick.

MALONE, N. Y.—Bids will be received by John P. Badger, president of Board of Trustees North New York Institution for Deaf Mutes, Malone, N. Y., until Aug. 16 for construction, including heating, plumbing and electric work for the administration building, including alterations in existing rear extension, and for two dormitory buildings for boys and grls at the Northern Institution for Deaf Mutes, Malone, N. Y. Drawings and specifications may be consulted and blank form of proposal obtained at the Northern Institution for Deaf Mutes, Malone, N. Y., and at the office of Franklin B. Ware, State Architect, Albany, N. Y. Copies of plans and specifications may be obtained upon application to the State Architect.

NEW YORK, N. Y.—The contract for furnishing and installing boilers and accessories in power house of the Metropolitan Hospital, Blackwell's Island, has been awarded to Osborne Rae & Company, 241 West Forty-first Street, New York, N. Y., for $12,521.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Aug. 15 for furnishing all material and labor for certain excavation, masonry, steel and iron work, painting and plumbing work, power work and machinery, refrigerating work, electric work and all the other work in connection with the completion of an administration building, a surgical pavilion and dining-hall building, a service tunnel and covered corridor connecting buildings, ambulance and laundry building and also power work and machinery, etc., for six-ward pavilions, now under contract, for the Seaview Hospital, situated on the property of the Department of Public Charities, in the borough of Richmond, N. Y. Blank forms and further information may be obtained at the office of Raymond E. Almirall, 185 Madison Avenue, New York, N. Y., architect, where plans and specifications may be seen. Michael J. Drummond is commissioner of public charities.

SAND LAKE, N. Y.—A franchise has been granted by the Public Service Commission, Second District, to the Wynantskill Hydroelectric Company for the construction of an electric generating plant at Wynantskill Creek in the town of Sand Lake. Work on the plant, which is to supply electricity to West Sand Lake, Snyder's Lake, Reichard's Lake, Averill Park, Sand Lake, Crooked Lake, Burden Lake and other towns in the vicinity, will be commenced at once.

WARSAW, N. Y.—The Village Trustees have awarded a contract to the Warsaw Gas & Electric Company for lighting the streets of the village for a period of five years. Under the terms of the contract the company is to furnish thirty-two arc lamps at $75 each per year and forty incandescent lamps at $15 per lamp per year.

SHALLOTTE, N. C.—The Seaside, Shallotte & Wilmington Telephone Company, it is reported, is making arrangements to erect a telephone line, 25 miles in length. Bids for construction of the line will be received until Aug. 25. Walter Leonard, of Supply, N. C., is secretary.

FESSENDEN, N. D.—It is the intention of the Maple Leaf Telephone Company to extend its lines in Fessenden, a franchise to that end having been granted by the County Board.

PAYNE, OHIO.—At an election held recently the proposition to issue bonds for the purchase of the local electric-light plant and the installation of a water-works system was carried. The cost of the electric plant is estimated at $9,700 and the water-works at $17,000.

MULDROW, OKLA.—It is reported that the city is contemplating calling an election to vote on the proposition to issue bonds for the installation of electric-light and water-works systems in Muldrow.

MUSKOGEE, OKLA.—Sealed bids will be received by the City Council of Muskogee, Okla., until Aug. 29 for furnishing and erecting the following pumping machinery: One 1,600,000-gal. low-lift centrifugal pump; one 1,600,000-gal. high-lift centrifugal pump, and one 1,300,000-gal. high-lift centrifugal pump. Bids will be received alternately for direct connection with electric motors and steam turbines. Specifications may be obtained at the office of the city engineer or at the office of Alexander Potter, 114 Liberty Street, New York, N. Y., consulting engineer. All bids to be addressed to E. H. Fleming, city clerk.

ASHLAND, ORE.—It is stated that the franchise of the Ashland Electric Light & Power Company has been revoked, and that the city's municipal plant will soon be in operation.

KLAMATH FALLS, ORE.—The Siskiyou Electric Power & Light Company, of Yreka, Cal., which recently acquired control of the local power plants in this city, contemplates the construction of a transmission line from its Fall Creek plant to Klamath Falls.

MONROE, ORE.—It is reported that the Welch interests are planning to equip the Carver railway from Corvallis to Monroe at once for electrical operation and to push the completion of the line from Monroe to Eugene.

MOSIER, ORE.—Arrangements are being made by the Pacific Light & Power Company to erect a transmission line to Mosier to supply electricity for lamps and motors in this town.

ONTARIO, ORE.—Plans are being made by the Ontario-Nyssa Irrigation Company for building an irrigation system to irrigate 10,000 acres of land between Ontario and Nyssa. It is understood that funds have been provided for the construction of the Shoestring ditch and the installation of an 1800-hp electric pumping plant. The officers of the company are: A. W. Trow, president; E. M. Grieg, vice-president; E. H. Test, secretary, and W. H. Doolittle, treasurer.

PORTLAND, ORE.—Preparations are being made for the installation of an electric-light system in Burlington, the industrial suburb on the Spokane, Portland & Seattle, Northern Pacific and United Railways. The power station has been completed and machinery will soon be installed.

CHESTER, PA.—The A. P. Witteman Company, Fourth and Booth Streets, Chester, Pa., is building a new power house, 40 ft. x 50 ft. A 150-kw generator will be installed.

JOHNSTOWN, PA.—Plans are being made for substituting electricity for steam as the motive power for operating the Cambria Incline Plane in the near future. Energy for operating the cars will be furnished by the power plant of the Cambria Steel Company. The steam plant will be abandoned.

LANCASTER, PA.—The property of the Manheim & Mount Joy Electric Light Company has been purchased by the Susquehanna Railway & Light Company. The company supplies electrical service in Manheim and Mount Joy.

MEADVILLE, PA.—The Northwestern Pennsylvania Railway Company has placed contracts with the General Electric Company, of Schenectady, N. Y., for three generators, two for the power plant in Meadville and one for the Harmonsburg substation, to cost $15,500. The greater portion of the increased output of the plant will be utilized on the Cambridge Springs line, which the company has recently taken over. It is proposed to install new motors in the present cars and make other improvements to the service.

MILTON, PA.—It is reported that plans are being prepared by Henry & West, of Philadelphia, Pa., who control the United Light & Power Company, of Milton, Pa., for consolidating all the light and power properties between and including Milton and Sunbury into one company,

to be capitalized at $2,000,000. The proposed new corporation will take over the following electric and gas plants: Edison and Middle Creek Electric Illuminating Companies, Sunbury Light & Power Company, Sunbury Gas Company, Northumberland Electric Illuminating Company, the United Light & Power Company, of Milton, and the leasehold of the United Light & Power Company and of the Lewisburg Electric Light Company, of Lewisburg, for a period of ninety-nine years.

NANTY GLO, PA.—Improvements representing an expenditure of over $25,000 are under way at the plant of the Nanty Glo Light, Heat & Power Company, the controlling interest in which was recently acquired by Ebensburg capitalists. The plans for the new work, which are being prepared by C. C. Dovey, of the Swank Building, include the construction of a modern brick power house, of sufficient size to accommodate six 900-hp boilers and three 2220-volt alternators. In addition to supplying electricity for lamps in Nanty Glo, the company will also supply motor service to the nearby mines. The officers of the company are: President, T. P. Burns, Nanty Glo; secretary and treasurer, Walter Jones, Ebensburg. These, in addition to T. Stanton Davis, Ebensburg; E. B. Nairn and Ed. Smith, of Nanty Glo, comprise the board of directors. The offices are in the Cambria Trust Company's Building, Ebensburg.

NEW CASTLE, PA.—It is the intention of the Mahoning & Shenango Valley Railway to enlarge its generating station and install new equipment at Sharon.

SHICKSHINNY, PA.—Negotiations have been completed whereby the municipal electric-light plant will be abandoned and electricity for operating the local system will be obtained from the Luzerne County Gas & Electric Company, of Plymouth, Pa. The service from the municipal electric plant has been unsatisfactory for some time and was available at night only. The price paid for the plant is said to be about $10,000.

WILKES-BARRE, PA.—The Central Poor Directors are reported to have awarded a contract on Aug. 3 for furnishing the new electric engine, generator, switchboard and other appliances to E. F. Roth, of Wilkes-Barre, for $6,956.

EDGEFIELD, S. C.—The proposition to issue bonds to the amount of $15,000, the proceeds to be used for the construction of an electric-light plant, it is reported, will be submitted again to the voters on Aug. 21. J. B. McCrary & Company, Empire Building, Atlanta, Ga., are engineers; W. H. Harling is clerk and treasurer.

ENOREE, S. C.—The Enoree Manufacturing Company, of Enoree, S. C., has awarded a contract to the Irwin Electric Company, of Spartanburg, S. C., for the installation of a 100-kw electric plant. Electricity generated at the plant will be used to operate the ginnery and for lighting streets, cotton mill, stores and residences of the village. The plant will be operated by water-power. General Electric equipment will be installed. Alternating-current system will be used. It is expected to have the plant in operation by Aug. 15.

LAKE CITY, S. C.—The Farmers' Union Ginning & Manufacturing Company is reported to be contemplating the installation of an electric-light plant.

ORANGEBURG, S. C.—The Commissioners of Public Works have placed a contract with the Western Electric Company for an engine and generator to be placed in the water and electric-light plant.

ROCK HILL, S. C.—Arrangements have been concluded for the installation of an improved system of lighting in the business district of Rock Hill, extending from the post office to Railroad Avenue on Main Street. There will be nine ornamental cast-iron posts on each side of the street, spaced 75 feet apart and surmounted with a cluster of five tungsten lamps.

CHATTANOOGA, TENN.—The Georgia Power Company is making preparations to extend its transmission lines from Rome, Ga., to Chattanooga, Tenn. The plant of the company is located at Tallulah Falls, Ga. The company was recently granted a charter by the State of Tennessee. The company is capitalized at $100,000 and the incorporators are: H. P. Boughton, J. E. M. Ellet, L. M. Coleman, W. L. Frierson and Paul Campbell.

KNOXVILLE, TENN.—Surveys are being made by the Georgia Power Company for the erection of its transmission lines from the power plant at Tallulah Falls, Ga., to Knoxville, Tenn., for the purpose of supplying electricity in Knoxville. Work has begun on the erection of the line between Tallulah Falls, Ga., and Franklin, N. C.

NASHVILLE, TENN.—The Nashville Railway & Light Company has recently purchased from Byrd Douglas the site of the latter's old warehouse, fronting on First and Second Avenues, the company's intention being to utilize it for an extension to its present power plant. However, no definite statement as to when the extension will be made has been given out.

PETERSBURG, TENN.—The question of establishing an electric-light plant in Petersburg is reported to be under consideration.

AUSTIN, TEX.—The Austin Electric Railway contemplates the extension of its lines to the site of the proposed dam across the Colorado River, about three miles west of the city.

AUSTIN, TEX.—A special election will be held in this city on Aug. 30, for the purpose of voting on the proposition of William D. Johnson, of Hartford, Conn., head of the Hydraulics Properties Company, of New York, for the construction of a dam across the Colorado River at Austin and the installation of a hydroelectric plant. Mr. Johnson has deposited $25,000 to the credit of the city, as a guarantee that the dam and hydroelectric plant will be constructed in accordance with the contract and specifications as agreed upon by him and the city commissioners. The proposed cost is $1,600,000. As stated in our issue of July 15, the City Council has already accepted the proposition as made by Mr. Johnson.

BUCKHOLTS, TEX.—It is reported that Dr. W. R. Newton, of Buckholts, Tex., would like to receive estimates of cost of installation of an electric-light plant for a sanitarium. The cost of the sanitarium is estimated at $10,000.

SAN ANTONIO, TEX.—The Medina Irrigation Company, headed by Dr. F. S. Pearson, of New York, has enlarged its plans for irrigating lands in different parts of south Texas. In addition to the large dam which it will erect across the Medina River, mention of which has already been made in these columns, it has filed water rights on the Guadalupe River at points 9 and 12 miles above Kerrville. Two auxiliary terminals will be constructed at the latter places for the purpose of storing water for the irrigation of 30,000 acres of land, in addition to the 100,000 acres to be irrigated in the valley of the Medina River. The cost of the dams and canal system near Kerrville will be approximately $2,000,000. Water rights on the Frio and Nueces Rivers in Uvalde County have also been filed, and two other large dams will be erected. The enlarged plans bring the estimated cost of the work up to $12,000,000.

TIOGA, TEX.—It is stated that the Commercial Club, of Tioga, Texas, is formulating plans for the construction of an interurban electric railway to run from McKinney to Gainesville, a distance of about fifty miles. The proposition is meeting with favor in the towns along the proposed route, and a company to carry out the project will soon be organized.

TYLER, TEX.—The City Council has closed a contract with the Tyler Electric Light Company for a large number of additional street lamps.

WILLS POINT, TEX.—Arrangements are being made to organize a stock company in Wills Point for the purpose of taking over the local electric plant, which was burned several weeks ago, and rebuilding the same. The company will be capitalized at $10,000. The directors are: J. H. Human, John E. Owens, E. A. Russell, W. H. Wingo, B. W. Bruce, R. W. Garrett and W. R. Howell.

FT. MONROE, VA.—Bids will be received at the office of the post quartermaster, Ft. Monroe, Va., until Aug. 16 for a small quantity of miscellaneous electrical material and 400 Star screw anchors. Captain Curtis G. Rorebeck is post quartermaster.

RICHMOND, VA.—Application has been made to the Council Committee on Electricity by the Virginia Railway & Power Company for permission to string temporary overhead wires from Ninth to Cary Streets to the new Chesapeake and Ohio First National Bank skyscraper site, where it is proposed to use electric hoists instead of the old style steam engines.

SUNNYSIDE, WASH.—The Pacific Power & Light Company has decided to extend its transmission lines to the Garden tracts to supply electricity for lamps and motors in that section.

MENASHA, WIS.—The City Council has awarded contracts for new equipment for the municipal electric plant as follows: To the Diesel Engine Company for a 225-hp engine and the Wagner Electric Company for a 200-kva generator and switchboard. The cost of the work is estimated at about $8,000.

MILWAUKEE, WIS.—About $1,000,000 is to be expended by the Wisconsin Telephone Company in the erection and equipment of modern exchanges at Milwaukee, Wauwatosa, Beloit, Appleton and Fond du Lac.

NORTH FREEDOM, WIS.—It is stated that O. Nelson and Arthur Voeck, who recently took over the plant and holdings of the North Freedom Electric Light Company, contemplate making extensive improvements in the newly acquired property.

OSCEOLA, WIS.—The plant and holdings of the Osceola Electric Light Company have been purchased by the Minneapolis General Electric Company, of Minneapolis, Minn. Electricity for operating the local service will be supplied from the latter company's plant at St. Croix Falls. A twenty-four-hour service will be furnished for both lamps and motors.

RANDOM LAKE, WIS.—The citizens have voted for the installation of a municipal electric-light plant.

WYOCENA, WIS.—The Columbia County Power Company is planning to establish a twenty-four-hour service and extend the transmission lines to Pardeeville and Kio to supply electricity for lamps and motors.

COBALT, ONT., CAN.—The plant of the Northern Ontario Light & Power Company, at South Porcupine, which was recently destroyed by fire, is being replaced rapidly. Larger generators have been ordered and larger boiler equipment is being provided for. The south end steam plant, in which large transformers will be installed, will be kept in reserve. Frank L. Cody, president of the company, announces that energy will be obtained from Sandy Falls within six weeks, and that the transmission line is to be run from South Porcupine to the end of the lake.

NAPANEE, ONT., CAN.—At an election held recently the by-law authorizing the town to sell the municipal electric plant to the Seymour

Power Company, of Campbellford, Ont., was carried. The Seymour Power Company is to pay the town about $40,000 for the municipal plant and agrees to supply electricity at the rate of 8 cents per kw-hour to private consumers. The town has entered into a thirty-year contract with the company to light the town.

TORONTO, ONT., CAN.—Bids will be received by registered post only addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, Aug. 15, 1911, for the supply and erection of electric-lighting fixtures for the filtration plant. Plans and specifications may be seen and forms of tender obtained from the Water Works Department at the office of the City Engineer, Toronto.

SASKATOON, SASK., CAN.—The municipal electric plant in Saskatoon was damaged on July 27 by a boiler explosion.

NECAXA, MEXICO.—It is stated that two additional 10,000-kw units have been installed by the Mexico Light & Power Company in its hydroelectric plant at this city, and that work on the new storage dam which the company is constructing will soon be finished.

SAN LUIS, MEX.—The local street railway system has been purchased by an English syndicate headed by Dr. F. S. Pearson, of New York, N. Y. It is stated that the new owners propose to make extensive improvements and extensions to the system, involving an expenditure of more than $1,000,000. The construction of an interurban line to the suburbs of Solebad will be among the first of the extensions. The Mexican Central Light & Power Company will provide electrical energy for operating the system.

## New Industrial Companies.

THE AMERICAN SMOKELESS FURNACE COMPANY, of Portland, Maine, has filed articles of incorporation with a capital stock of $500,000 for the purpose of manufacturing and dealing in furnaces, boilers, etc. C. E. Eaton is president and T. L. Corteau, treasurer, both of Portland, Maine.

THE ATLANTIC PERFECTED MOTOR COMPANY, of Atlantic City, N. J., has been incorporated with a capital stock of $250,000 by F. Brown, T. Kilcourse and S. S. Phoebus, of Atlantic City, N. J. The company proposes to manufacture motors, engines, etc.

THE CITY ELECTRIC OMNIBUS COMPANY, of Camden, N. J., has been incorporated with a capital stock of $500,000 by F. R. Hansell, John A. MacPeak and I. C. Crow, all of Camden, N. J.

THE GENERAL RAILWAY & MOTOR SAFETY APPLIANCE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing railway appliances by W. B. Sorsby, J. D. Wetmore, of New York, N. Y., and H. Kasberg, of Mount Vernon, N. Y.

THE GEYSER ELECTRIC COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $1,500,000. The company proposes to manufacture electric apparatus for heating water and other articles, etc. The chief works of the company will be located in Hartford, Conn. The incorporators are: Heath Sunderland, Frederick E. Anderson and Mabel N. Bacharach, of Hartford, Conn.; Andrew R. Nichols, of Seattle, Wash., and George S. Landers, of Boston, Mass.

THE WALTER T. GODDARD COMPANY, of Rochester, N. Y., has been incorporated by W. T. Goddard, Edna C. Goddard and Janet M. Cook, all of Rochester, N. Y. The company is capitalized at $5,000 and proposes to manufacture electrical machinery, etc.

THE INDIANA STEEL & IRON COMPANY, of Linton, Ind., has been incorporated with a capital stock of $100,000 by Marcus K. Frank, Joseph D. Karasik, Angernon Granville, Samuel R. Sobel, of Pittsburgh, Pa., and William J. Hamilton, of Linton, Ind.

THE McCUE COMPANY, of Buffalo, N. Y., has been incorporated by J. Willard Lansing, Ira T. Gleason, B. H. Bean and Henry A. Kamman, all of Buffalo, N. Y., and Charles T. McCue, of Hartford, Conn. The company is capitalized at $700,000 and proposes to manufacture electric, gasoline and steam vehicles.

THE NATIONAL INSULATOR COMPANY, of Camden, N. J., has been incorporated with a capital stock of $500,000 for the purpose of manufacturing glass and other insulators for carrying wires for electric current, etc. J. E. Inman of Hartford, Conn.; J. F. Harned and W. C. Aitken, of Camden, N. J., are incorporators.

THE PEERLESS ELECTRIC SIGN COMPANY, of Kansas City, Mo., has been granted a charter with a capital stock of $35,000. The incorporators are: John C. Meredith, W. R. Bump and F. C. Sharon.

THE PORTLAND ELECTROCHEMICAL COMPANY, of Portland, Maine, has filed articles of incorporation with a capital stock of $200,000 to manufacture and sell electrochemical machinery and products. The incorporators are: Scott Wilson, Ethel M. Dyer and S. Wilson, all of Portland, Ore.

THE PUBLIC SERVICE CONTRACTING COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $50,000 by DeL. Kankine, W. M. Huntley and L. E. R. French, all of Buffalo. The company proposes to do a general contracting business.

THE SCHIETZEL ELECTRIC SHOT-FIRING MACHINE COMPANY, of Omaha, Neb., has been chartered with a capital stock of $100,000.

THE STANDARD ELECTRIC STOP COMPANY has been incorporated under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are: S. D. Townsend, Jr., of Wilmington, Del.; J. P. Kirnan, Jr., and F. A. Barnett, of Philadelphia, Pa.

THE STANDARD ELECTRIC MANUFACTURING COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $2,000 to manufacture and sell electric fixtures and specialties. The incorporators are: Earl O. Immel, George N. B. Lowes and Lester L. Falk.

THE UNIVERSAL AUTOMATIC ELECTRIC SIGNALING COMPANY, of La Crosse, Wis., has filed articles of incorporation with a capital stock of $28,000.

THE WESTERN ELECTRIC INSTALLATION COMPANY, of Kansas City, Mo., has been incorporated with a capital stock of $5,000 by William L. Hall, Benjamin F. Shambaugh and John B. Young.

## New Incorporations.

SACRAMENTO, CAL.—The Sacramento-Woodland Electric Railroad Company has filed articles of incorporation with a capital stock of $1,000,000 to build an electric railway from Sacramento to Woodlawn, a distance of 17 miles. A bond issue of the same amount of the capital has been provided for, of which $750,000 will be used for the construction of the proposed railway and the remainder will be held for extension and maintenance. Work on construction of the road, it is said, will begin within thirty days. T. G. Gregory is president.

WILMINGTON, DEL.—Articles of incorporation have been filed for the British North American Power Company with a capital stock of $1,300,000 by Warren N. Akers, Millard C. Taylor and William J. Maloney, of Wilmington, Del.

MILLEN, GA.—The Millen & Newington Railroad Company has applied for a charter for the purpose of building an electric railway extending from Millen or Newington to some point on the Brinson Railway in Screven County. The company is capitalized at $75,000. The incorporators are: E. S. Lane, H. S. McCall, W. H. Marsh, W. M. Parker, A. S. Anderson and others.

CALAIS, MAINE.—The Eastern Telephone & Telegraph Company has been incorporated with a capital stock of $200,000 to operate telephone and telegraph lines in Washington County. W. S. Alexander, of Eastport, Maine, is president of the company and E. E. Talbot, of Machias, Maine, is treasurer.

HARTLAND, MAINE.—The Hartland Electric Light & Power Company has been incorporated with a capital stock of $5,000 for the purpose of supplying electricity in the towns of Hartland, Palmyra, St. Albans, Harmony, Athens, Canaan and Cornville. The officers of the company are: C. A. Moulton, president; Carl Randlett, treasurer, and R. C. Hamilton, clerk, all of Hartland, Maine.

PORTLAND, MAINE.—The Des Moines River Power Company has filed articles of incorporation with a capital stock of $500,000 for the purpose of developing power sites on the Des Moines River in Iowa; also to construct and operate hydroelectric plants. C. E. Eaton is president and T. J. Croteau treasurer, both of Portland, Ore.

SPRINGFIELD, MASS.—Articles of incorporation have been filed for the Springfield Northwestern Interurban Railroad to build an electric railway from Springfield to Petersburg and Mason City, via Greenview and Athens. The company is capitalized at $15,000. The incorporators are: Homer T. Rice, of Greenview; Richard Y. Kincaid, of Athens; Samuel E. Prather, George L. Harnsberger and W. Frank Workman, all of Springfield.

TUCUMCARI, N. M.—The Tucumcari Light & Power Company has been incorporated with a capital stock of $100,000 by R. G. Lafite, Henry Swan and O. F. Edlar, all of Tucumcari.

COLUMBUS, OHIO.—The Cleveland & Youngstown Railroad Company has been chartered with a capital stock for the purpose of constructing an electric railway between Cleveland and Youngstown, via Cuyahoga, Portage, Trumbull and Mahoning Counties, which, it is expected, will be extended eventually to Leavittsburg. The incorporators are: James P. Wilson, Fred J. Heim, Theodore A. Johnson, John T. Harrington and Thomas A. Jacobs.

COCALICO, PA.—The West Cocalico Electric Light & Power Company of Lancaster County has been granted a charter by the State Department with a capital stock of $5,000.

DELTA, PA.—Articles of incorporation have been filed for the Delta Telephone Company with a capital stock of $10,000. The directors are: Fred N. Ramsay, of Delta, Pa., treasurer; E. W. Keyser, of Bridgeton, Pa., and Jacob E. Weaver, of York, Pa.

GRAMPIAN, PA.—The Grampian Electric Company has been incorporated with a capital stock of $5,000. The directors are: John W. Wrigley, of Clearfield, Pa., treasurer; Jonathan Currier, of Grampian, Pa.; A. W. Lee, J. H. J. Thompson, Heber H. Straw, all of Clearfield, Pa.

HARRISBURGH, PA.—Charters have been granted by the State department to the following companies: The Allegheny Light, Heat & Power Company; the Blacklick Light, Heat & Power Company; the Cresson Light, Heat & Power Company; the Gallitzin Light, Heat & Power Com-

pany; the Summer Hill Light, Heat & Power Company, and the Washington Light, Heat & Power Company. Each company is capitalized at $5,000 and the directors are: James Collins Jones, 1531 North Fifteenth Street, Philadelphia, Pa.; Jacob Mann and Floyd Woodcock, both of Philadelphia, Pa.

HARRISBURG, PA.—Charters have been granted by the Secretary of State for twenty-five electric companies to operate in Allegheny, Washington and Greene Counties as follows: Washington Union Electric Company, East Washington, Smith Township, North Strabane Township, South Strabane Township, North Franklin Township, South Franklin Township, Houston, Morris Township, Chartiers Township, Canton Township, Cecil Township, Amwell Township, Pleasant Valley, Mount Pleasant Township and Burgettstown, all of Washington; Oak Borough Electric Company, North Fayette Township, South Fayette Township, Findley Township and Collier Township, all of Oakdale; Canonsburg Union Electric Company, of Canonsburg, Pa.; Washington Township Electric Company, Franklin Township and East Waynesburg, of Waynesburg. Each company is capitalized at $5,000 and the incorporators are: C. H. Kennedy, of New Brighton, Pa.; E. S. Wheeler and H. P. Carr, of Pittsburgh, Pa.

McCONNELLSBURG, PA.—The McConnellsburg & Breezewood Telephone Company has been chartered with a capital stock of $15,000. The directors are: William C. Hanks, of Clearville, Pa., treasurer; Amos Hixson, of Crystal Springs, Pa.; James F. Pee, Dr. J. Grant Hanks, A. C. Clevenger, of Breezewood, Pa.; George A. Harris, B. C. Lamberson, of McConnellsburg, Pa., and Dr. James M. McKibbin, of Buck Valley, Pa.

MOOSIC, PA.—A charter has been granted by the State Department to the Moosic Electric Company, of Moosic, Pa. The company is capitalized at $5,000.

NEW BRIGHTON, PA.—The College Hill Electric Company has been granted a charter with a capital stock of $30,000. The directors are: Julius Theobald, of New Brighton, Pa., treasurer; A. L. Mitchell, of Freedom, Pa., and H. Clyde Harker, of New Brighton, Pa.

NEWMANSTOWN, PA.—A charter has been granted by the State Department to the Denver Electric Light, Heat & Power Company with a capital stock of $5,000.

SAUCONA, PA.—The Saucona Electric Light, Heat & Power Company has been granted a charter by the State department with a capital stock of $5,000. The directors are: H. M. Ueberroth, of South Bethlehem, Pa., treasurer; A. C. Graham, P. F. Enright, James M. Degnan, Charles H. Green and C. A. Buck, all of South Bethlehem, Pa.

PETERSBURG, TENN.—A charter has been granted to the Petersburg Electric Light & Power Company. The company is capitalized at $2,100, and the incorporators are: A. C. Davis, George McAdams, J. A. Montgomery, J. C. McRady and O. F. Gill.

FT. WORTH, TEX.—The Ft. Worth Southern Traction Company has been incorporated with a capital stock of $1,500,000 by G. H. Clifford, W. C. Forbes and W. A. Hanger, all of Ft. Worth, Tex. The company proposes to construct and operate an electric interurban line between Ft. Worth and Cleburne.

GROTON, VT.—Articles of incorporation have been filed for the Groton Electric Company by T. B. Hall, J. F. Hatch, R. A. Davidson, L. S. Blanchard and E. F. Clark, all of Groton, Vt. The company is capitalized at $35,000 and proposes to acquire and build an electrical plant in Groton and other places in Caledonia County.

DANVILLE, VA.—The Danville Traction & Power Company has been incorporated with a capital stock of (maximum) $500,000. (minimum) $200,000. The company proposes to operate a street-railway system and power plant. The officers are: John F. Risen, president; J. R. Jopling, vice-president, and H. S. Lanie, secretary and treasurer.

WEST POINT, VA.—Articles of incorporation have been filed for the People's Light, Heat & Power Corporation with a capital stock of $25,000. The officers of the company are: J. H. McRae, president; Crosby Thompson, vice-president; A. J. Bagby, secretary, and H. E. Topping, treasurer.

NEWPORT, WASH.—The Metaline Falls Light & Power Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are: Lewis P. Larson, Jens Jensen and Harry W. Reading.

CHARLESTON, W. VA.—The Charleston-Dunbar Traction Company has been incorporated with a capital stock of $150,000 by Fred Paul Grosscup, Paul B. Grosscup, W. C. Davidson, J. Gluck and H. D. Rummel, all of Charleston, W. Va.

CHARLESTOWN, W. VA.—The Citizens' Electric Company has been incorporated with a capital stock of $50,000 by Thomas C. Dowling, H. C. Getyendanner, Gerard D. Moore, G. E. Hughes and B. L. Langden.

HINTON, W. VA.—The Dominion Power Company has been granted a charter by the Secretary of State with a capital stock of $100,000. The incorporators are: J. J. Mott, of Statesville, N. C.; J. A. Mott, of Hickory, N. C.; Marion Butler, of Elliott, N. C.; S. B. Thomas and R. F. Dunlap, of Hinton, W. Va. The company proposes to furnish power and erect manufacturing plants in Summers and other counties in West Virginia.

MORGANTOWN, W. VA.—The Masontown-Morgantown Street Railway Company has been incorporated with a capital stock of $30,000. The directors are: Byron Trimble, 245 Atwood Street, Pittsburgh, Pa., president; C. W. Scheck, of Mount Lebanon, Pa.; A. E. DuBois, of Pittsburgh, Pa.; Charles C. McBride, of Ingram, Pa., and W. F. Craig, of Swissvale, Pa.

NEW CUMBERLAND, W. VA.—The Hancock Electric Company has been organized with a capital stock of $12,000 by John F. Flood, Harry E. Armstrong, Nelson D. Miller, Samuel McCoy and Samuel G. Stewart, of Steubenville, Ohio. The company proposes to construct and operate a power house.

MILWAUKEE, WIS.—The Co-operative Electric Company has been chartered with a capital stock of $4,000 by H. H. Schermerhorn, Fred J. Schermerhorn and J. A. Mueller.

## Personal.

*MR. JAMES D. HOGARTH* has been appointed general superintendent of the Chicago Railways Company, with which he has been connected the past three years as general statistician.

*MR. D. McFARLAN MOORE* has been awarded the John Scott legacy medal and premium by the city of Philadelphia upon the recommendation of the Franklin Institute for his vacuum-tube electric light.

*MR. JAMES B. BROKAW* has been transferred from the American Falls plant of the Idaho Consolidated Power Company to Black Foot, Idaho, to become local manager, succeeding Mr. C. S. Douglas, recently deceased.

*MR. K. A. ALBRECHT*, whose return to Europe was noted in this column on April 13, has joined the staff of the Siemens-Schuckert Works, Berlin. It is probable that Mr. Albrecht will later sail for South America.

*MR. C. S. DAVIDSON* has resigned as manager of the street-lighting department of the Holophane Company, in order to become associated with the Manufacturers' Agency of W. G. A. Reid, Detroit, Mich., in which he has acquired an interest.

*MR. R. B. HERTZOG* resigned as general superintendent of the Chicago Railways Company upon the completion of his twentieth year of service with the company and its predecessors in order to accept an advantageous offer from a railway supply house.

*MR. H. B. TILLEY*, manager of Messrs. Bruce Peebles' office in Manchester, has arrived in Canada for an extended business tour in that country on behalf of his firm. Mr. Tilley will visit all places of importance in the Dominion and expects to be away from England for fully a year.

*MR. HENRY B. OTIS* has retired from the firm of Rush, Otis & Company, contracting electrical engineers, of Chicago, to become a member of the firm of Yard, Otis & Taylor, bond brokers. C. G. Rush & Company will continue the business formerly carried on by Rush, Otis & Company.

*MR. ARTHUR R. HILL* has resigned as purchasing agent to the New York & Queens Electric Light & Power Company, of Long Island City, N. Y., to accept the position of purchasing agent to the Monterey Railway, Light & Power Company, of Monterey, Mexico, which also includes the Monterey Water Works & Drainage Company, the Monterey Plumbing & Electrical Supply Company and the Monterey Gas Company

*MR. BRITTON I. BUDD*, whose election as president of the Metropolitan West Side Elevated Railway Company, Chicago, was noted in our issue for Feb. 17, 1910, has been chosen head of the Chicago Elevated Railways, the new concern which has absorbed the four elevated railways and the so-called loop. Mr. E. C. Noe, now general superintendent of the Northwestern Elevated, will act as general superintendent of the combined systems.

*MR. SAMUEL INSULL* has returned to Chicago after a month's vacation abroad. Mr. Insull went to England to attend the sixtieth wedding anniversary of his parents, and he found them both in good health. Mr. Insull returned to New York on the *Lusitania* and that ship passed the outward bound *Mauretania* on which Thomas A. Edison was a passenger. Mr. Insull sent Mr. Edison a wireless message while they were both at sea, congratulating his old chief on his long-deferred vacation journey.

*MR. E. M. WHARFF* has been transferred from the operating engineering department of the Illinois Traction System and Western Railways & Light Company, at Peoria, Ill., to the position of assistant general superintendent at Galesburg of the Galesburg Railway & Light Company, which is controlled by the Western Railways & Light Company. Mr. Wharff will have direct charge of the light and power, electric railway, gas and steam-heating departments, including power-house, car barns and gas works.

*MR. ALONZO PAWLING*, president and treasurer of the Pawling & Harnischfeger Company, Milwaukee, and for years a prominent figure in the machinery field, has disposed of his interests in the company and retired from business life. In December, 1884, Mr. Pawling, together with Mr. Henry Harnischfeger, founded the present company, which from a small beginning has grown to large proportions. Mr. Harnischfeger now becomes president and treasurer of the company, Mr. W. H. Hassenplug first vice-president, Mr. F. P. Breck second vice-president, and Mr. S. H. Squier secretary

## Obituary.

*MR. THOMAS SAUNDERS*, one of the organizers and a director of the original company that promoted the Bell Telephone, died at Derry, N. H., Aug. 7. Mr. Saunders, whose home was in Haverhill, Mass., was making a trip by carriage to Barre, Vt., when he was seized with an attack of heart disease and was forced to stop at a farmhouse in Derry, where he died. Mr. Saunders' home was originally in Salem, Mass., where he came to know Alexander Graham Bell. He is said to have owned at one time half of the stock of the original Bell company. He was for twenty years senior warden of the Trinity Episcopal Church, Haverhill, was a member of the Knights Templars and a prominent Democrat. He leaves four daughters and two sons.

## Trade Publications.

PIPE-THREADING MACHINE.—The Toledo Pipe Threading Machine Company, Toledo, Ohio, has issued an attractive booklet with the caption "A Pipe-Threading Miracle," setting forth the story of the tools which are said to have changed all previously existing notions of the labor required to thread pipe by hand. The tools are also illustrated and described.

GAS-ELECTRIC MOTOR CAR.—The General Electric Company has just issued a handsome publication (Bulletin No. 4855) devoted to a detailed description of its double-truck type of gas-electric car. The publication is elaborately illustrated and contains considerable data relative to the subject. It includes plans and elevations of cars of various sizes.

GRAPHITIZED-FILAMENT INCANDESCENT LAMP.—In Bulletin No. 4853, recently issued by the General Electric Company, is described that company's "Gem" lamp. This lamp is intended to replace the carbon lamp as a free renewal lamp. The bulletin compares the carbon with the "Gem" lamp and shows the advantages derived by the use of the latter.

MERCURY-ARC RECTIFIERS—Folders 4204 and 4205 are two new publications of the Westinghouse Electric & Manufacturing Company, the subject of the former being "Telephone Battery Charging with Westinghouse-Cooper Hewitt Rectifier Outfit"; the latter is entitled "The Right Light" and covers the use of the rectified-current arc lamp with moving-picture machines.

STEAM VALVES AND SPECIALTIES.—The Ohio Brass Company, Mansfield, Ohio, has issued Catalog K, in which are illustrated and described the company's various valves and steam specialties, including gage cocks, water gages and ball-bearing glands. The catalog also contains instructions how to determine the proper size of regulating valves for a given service.

FORGING AND BENDING PRESSES.—Quick-acting steam hydraulic forging and bending presses, built under the Haniel and Lueg patents, are described in a catalog issued by the Mesta Machine Company, Pittsburgh, Pa. This type of press is said not only to reduce the labor and power cost, but also to produce forgings superior in quality to those made by the use of the steam hammer.

RENEWABLE CARTRIDGE FUSES.—The Columbia Sales Company, Pittsburgh, Pa., has issued a folder on the Columbia renewable cartridge fuses, the feature of which is the chuck terminal. The fuses are said to be easily renewed and to be adapted to any style of panelboard. They can be inspected without removal from the panelboard, and it is said to be impossible to reload them with fuse wire of the wrong capacity.

STORAGE-BATTERY BAGGAGE TRUCKS.—The Automatic Transportation Company, Buffalo, N. Y., builds an electric truck especially designed and constructed for handling baggage and freight at railway and steamship terminals, etc. The truck is said to accomplish a definite saving of from 25 per cent to 30 per cent over the former mode of hand trucking, and its make-up, uses and advantages are pointed out in a catalog issued by the company.

CENTRIFUGAL PUMPS.—Henry R. Worthington, New York, has issued two bulletins on centrifugal pumps; one, W-185, describing house and sump pumps, and the other, W-176A, describing pumps for low-head service. The latter type of pump is suitable for contracting work and irrigation plants, and while not as efficient as the standard volute pump built by the same maker, is well suited for the hard usage to which machinery is subjected in this class of work.

FIFTY-TON ELECTRIC LOCOMOTIVES FOR INTERURBAN CARS.—Bulletin No. 4852, just issued by the General Electric Company, contains a description of that company's standard 50-ton locomotive and its equipment, and a statement of features of construction which have made it particularly suitable for the requirements of the heaviest interurban roads. The bulletin contains, also, an information sheet for the use of those considering the adoption of such a locomotive.

MOVING COIL GALVANOMETERS.—Catalog No. 20 issued by the Leeds & Northrup Company, Philadelphia, Pa., devoted to moving-coil galvanometers, is divided into two parts, the first containing general information relative to galvanometers, and the second, specifications and price lists of galvanometers and accessories. The instruments are of the D'Arsonval type, although portable galvanometers of the moving-coil type as contrasted with the movable-magnet or Thomson type are also described.

RECORDING VOLTMETERS.—Bulletin No. 131, issued by the Bristol Company, Waterbury, Conn., is devoted to the company's recording voltmeters for direct-current and alternating-current circuits. The instruments are furnished in either switchboard or portable types, or, if desired, with moisture-proof cast-iron cases suitable for installation on poles wherever needed. Charts and schedules of increasing graduations and charts with fractional schedules of uniform graduations are listed for both currents.

TRANSFORMERS.—The Allis-Chalmers Company, Milwaukee, Wis., has issued Bulletin No. 1076 on its transformers, which are built in three types, as follows: Oil-filled, self-cooled; oil-filled, water-cooled, and air blast. The first are ordinarily built in sizes from 50 kva to 2000 kva; the second are built in sizes from 100 kva up, while the last are built in sizes from 75 kva up for voltages under 33,000. The features of merit of the various types are brought out in the description of each type contained in the bulletin.

ADVERTISING HINTS.—"A Little Booklet of Advertising Inspiration" is the title of a pamphlet recently issued by the Holophane Company, of Newark, Ohio, for distribution among central stations and contractors for use in their local newspaper advertising. The book contains ten electric-lighting advertisements, with appropriate cuts, and is prefaced by a number of short, pithy "ad hints." The advertisements, which were prepared by the Rae Company, deal with the lighting of some part of the home, from the front porch to the garage or barn, and are arranged for either single or double-column display.

WESTINGHOUSE PERPETUAL CATALOG.—The Westinghouse Electric & Manufacturing Company has issued revised editions of the following sections of its perpetual catalog No. 3001: No. 121 on Type CC carbon circuit breakers, No. 231 on expulsion-type fuse blocks, No. 233 on outdoor-type fuse blocks, No. 237 on type C watt-hour meters and No. 667 on type KD generator and feeder panels. These revised sections embody new features of interest. The following sections describe an entirely new line of switchboard meters which are very compact in size and yet retain the accuracy, the long scale and other advantageous features of the older types: No. 307 covers types L, SL and TL, switchboard meters; No. 310, type FM and TM switchboard meters; No. 311, types FD and TD frequency meters; No. 312, types FI and TI power-factor meters; No. 314, type TG electrostatic ground detectors and voltmeters; No. 327½, type OA watt-hour meters, and No. 436, new nursery milk warmers, while section No. 740 covers 75-kva and 100-kva distributing transformers.

## BUSINESS NOTES.

PITTSBURGH TRANSFORMER ORDERS.—The Sanitary District of Chicago has awarded a contract for sixteen 250-kw, 12,000-volt, 60-cycle Pittsburgh transformers to be used in the new city lighting scheme, power being secured from the Chicago Drainage Canal. This contract was secured by the Republic Electric Company, Chicago, Ill., whose business has recently been consolidated with that of the Delta-Star Electric Company, Western agent of the Pittsburgh Transformer Company.

MR. ARTHUR H. ALLEN, 1011 Franklin Bank Building, Philadelphia, has been appointed district agent for Philadelphia territory for the Allen-Bradley Company, of Milwaukee, Wis. Mr. Allen formerly represented the American Electric Fuse Company, and he is responsible for the introduction and extended use of the Allen-Bradley type of starters and controllers in the territory. Mr. Allen also represents the Triumph Electric Company, of Cincinnati, and reports an increasing demand for Triumph apparatus.

ADDITIONS TO GREGORY ELECTRIC COMPANY'S STAFF.—Mr. E. E. Protherow has joined the staff of the Gregory Electric Company in Chicago and will hereafter devote himself to the sale of motors for that company in Chicago and adjacent territory. Mr. Protherow was for six years with the Chicago office of the Crocker-Wheeler Company and has a large acquaintance in the electrical field. Mr. R. D. May has also joined the selling force of the company. Mr. May has had wide experience and enjoys a large acquaintance among the central-station men of the country and was a number of years connected with H. M. Byllesby & Company, looking after their interests at Enid, Okla., and Missoula, Mont.

CHANGES IN FOSTORIA GLASS SPECIALTY COMPANY.—The manufacture of upright air-hole gas chimneys (but not of shades and reflectors for gas burners) has been discontinued by the Fostoria Glass Specialty Company, of Fostoria, Ohio, as the company's plant capacity is taxed to keep up with the growing demand for the higher grades of glassware, particularly of the iridescent variety. The new Fostoria glass factory at Niles, Ohio, is now being operated at full capacity. The following changes have recently, although not concurrently, taken place in the management and personnel of the Fostoria Glass Specialty Company: Mr. E. O. Cross has succeeded Mr. M. H. Lemen, retired, as manager of the company, and Mr. R. E. Briggs has been constituted assistant manager in general charge of sales. Mr. B. C. Coleman, who has just concluded five years of successful experience in the fixture business, will be the company's Western representative, while the Eastern territory will be covered by Mr. Raymond P. Adams, formerly of the engineering department of the National Electric Lamp Association.

# Weekly Record of Electrical Patents

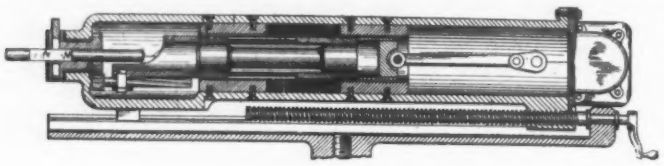
UNITED STATES PATENTS ISSUED AUG. 1, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

999,196. APPLIANCE FOR PREVENTING FRAUD IN CONNECTION WITH ELECTRICITY METERS; G. Berardi, Genoa, Italy. App. filed Aug. 21, 1909. If a magnet is brought near a meter to slow it down, the magnetic flux causes a shunt circuit to be completed and thus opens the working circuit or actuates an indicator.

999,235. PROCESS FOR THE PRODUCTION OF TUNGSTEN FILAMENTS; A. Lederer, Vienna, Austria-Hungary. App. filed June 10, 1908. An oxid of tungsten is reduced by means of zinc at a red heat. The product is treated with acid, then washed, concentrated and squirted into filaments.

999,241. HEATING AND DRYING MACHINE; F. P. Miles, Chicago, Ill. App. filed May 16, 1910. A heating device in a portable casing and a motor and fan for drawing air through the heater.



999,433.—Drill or Other Impact Mechanism.

999,245. FEEDER-REGULATING TRANSFORMER; G. S. Neeley, St. Louis, Mo. App. filed Aug. 27, 1909. The primary circuit is broken when the movable lever is on a non-active contact and is reconnected before it reaches the first active contact.

999,298. ELECTRIC SAFETY LAMP; B. Christiansen, Cologne-Sülz, Germany. App. filed April 4, 1911. A storage battery and current conductors are arranged in a casing. The handle prevents removal of the glass protecting bell.

999,309. PROCESS OF UNITING METAL ELEMENTS; C. F. Jacobs, Chicago, Ill. App. filed Aug. 21, 1909. For rail bonds. Loose fusible current-conducting material is fused in the point.

999,312. TROLLEY SWITCH FOR STATION INDICATORS AND THE LIKE; O. E. Kellum, Los Angeles, Cal. App. filed Nov. 23, 1910. The stationary contact is suspended from the trolley wire, so that the moving contact on the trolley pole pushes down on the stationary contact to prevent jumping off.

999,316. RAILWAY SIGNAL AND SAFETY DEVICE; C. H. Kirkendall, Columbus, Ohio. App. filed Aug. 15, 1910. A trip is pivoted to move in a slot in a guard rail and connected to a semaphore.

999,335. MAGNETO-GENERATOR; W. D. and J. R. Pennington, Chicago, Ill. App. filed Jan. 20, 1910. Metallic cores with coils are arranged between the converging faces of C-shaped permanent magnets and are relatively rotatable.

999,340. ARC LAMP; O. A. Ross, Chicago, Ill. App. filed May 29, 1902. An electrode is guided between parallel rods and a ring clutch is pivoted at one end to the rods and moved by an electromagnetic device.

999,367. CALL SYSTEM FOR TELEPHONE CIRCUITS; J. J. Graf, Scranton, Pa. App. filed May 26, 1910. For train dispatcher, etc. The selector apparatus of a substation may be operated from the central office to effect a connection with the main of a normally disconnected outlying circuit.

999,414 HIGH-TENSION STRAIN INSULATOR; L. Steinberger, New York, N. Y. App. filed Feb. 18, 1910. For wireless telegraphy, etc. Two U-shaped tension members pass through opposite ends of an insulating member and are interlocked but with insulation surrounding and between them.

999,421. ELECTRIC IRON; A. Wicks, Ontario, Canada. App. filed March 16, 1911. A smoothing iron heated at the bottom, but thermally insulated at the top.

999,433. DRILL OR OTHER IMPACT MECHANISM; G. H. Condict, Plainfield, N. J. App filed May 31, 1907. Solenoid reciprocation by direct current without reversal.

999,443. DANGER SIGNAL FOR RAILROADS; J. J. Flynn, St. Louis, Mo. App. filed March 2, 1911. Weights supported by the roadbed and alarm devices. To indicate washouts and settling or failure of bridges.

999,444. ELECTRIC SIGNALING SYSTEM FOR RAILWAYS; T. N. Freeble, Rochester, Pa. App. filed June 21, 1909. Improvement on Patent No. 900,273. The rails and a third conductor are used as conductors. To signal to the engineer and automatically slow up the train.

999,494. PROCESS OF TREATING EARTHY MATERIALS; C. Ellis, Montclair, N. J. App. filed Feb. 25, 1911. For cement or phosphate burning. The material is heated by an electric arc in air and then the nitrogen oxid is removed from the air.

999,505. COMPOSITE TELEPHONE AND TELEGRAPH SYSTEM; O. M. Leich, Genoa, Ill. Intercommunicating telephone. The telephones have talking circuits in bridge with the telegraph devices.

999,520. SAFETY DEVICE FOR REVERSIBLE WINDING OR HAULING PLANTS; W. Philip, Germiston, Transvaal. App. filed Aug. 30, 1909. For mine cars, etc. The operator is notified if the reversing mechanism is in a dangerous position.

999,521. BINDING BLOCK FOR TERMINAL WIRES; C. D. Platt, Bridgeport, Conn. App. filed May 7, 1910. A plug cut-out or rosette with a lock to prevent disturbance of the connections.

999,534. MULTIPLE-UNIT COIL; E. C. Wilcox, Meriden, Conn. App. filed Jan. 10, 1910. Spark coil for ignition. A single vibrator controls all the units of a group of coils and is reversible and interchangeable. The units are independently removable from a casing.

999,541. ELECTRICALLY HEATED FLATIRON; R. W. Baker, V. L. King and H. C. Parker, New York, N. Y. App. filed Dec. 29, 1909. The resistor element is made of exposed filaments of a solid solution of silicon carbide in carbon called "silundum."

999,543. APPARATUS FOR PRODUCING UNDAMPED ELECTRICAL OSCILLATIONS; E. S. Beck, Treichlers, Pa. App. filed Jan. 28, 1910. Blunt and pointed electrodes are slightly submerged in liquid. A source of continuous current is connected with the electrodes and an alternating current includes the electrodes and also inductance and capacity.

999,565. VIBRATOR FOR INDUCTION COILS; E. B. Jacobson, Pittsfield, Mass. App. filed Aug. 31, 1910. Adjustment device and means for locking it.

999,568. ELECTROLYTE AND METHOD OF DEPOSITING ZINC; E. F. Kern, Knoxville, Tenn. App. filed Dec. 18, 1909. Double chloride of zinc and aluminum, chloride of sodium and grape sugar is electrolyzed.

999,578. ELECTRIC CONTROLLER; L. A. De Mayo, New York, N. Y. App. filed March 20, 1909. For motors, etc., automatic cut-out.

999,581. PRESSING IRONS; F. A. Mills, New York, N. Y. App. filed Aug. 18, 1908. Hinged pressers with handles; electric heating. For pressing trousers while they are being worn.

999,586. ELECTRIC FURNACE; H. Pauling, Gelsenkirchen, Germany. App. filed March 17, 1909. For treating gases as in the manufacture of nitrogen oxids. Has a series of air inlets and gas outlets alternately with each other.

999,587. ELECTRIC FURNACE FOR TREATING GASES; H. Pauling, Gelsenkirchen, Germany. App. filed March 27, 1911. The surface of the furnace walls is subdivided into a number of areas, separated by gas passages to prevent loss of heat by radiation.

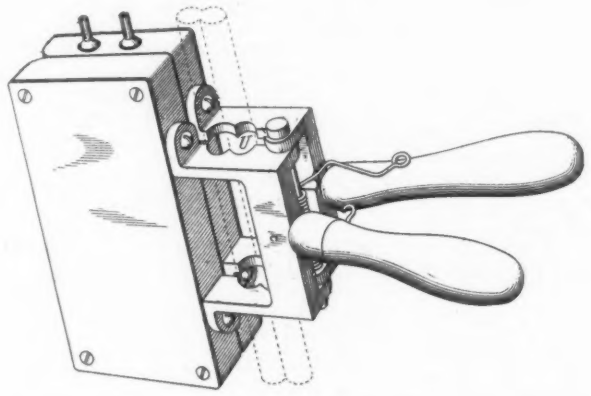
999,618. ELECTRIC COOKER; L. Yancey and J. W. Luppold, Denver, Col. App. filed Feb. 21, 1911. Heating coils are arranged in the bottom of a removable oven in an insulating receptacle and air passages are provided around and through the oven.

999,624. TROLLEY; R. Black, Canonsburg, Pa. The trolley pole is made of tubing with a right-angle elbow between the car top and the wheel.

999,655. ELECTROLYTE FOR DEPOSITING ZINC; E. F. Kern, New York, N. Y. App. filed Oct. 11, 1910. Zinc chloride, sodium aluminum, chloride, sodium chloride, grape sugar and water.

999,683. INSULATOR; A. R. Tinsley, Anstead, W. Va. App. filed March 1, 1910. A cap is located between spaced, headed standards and a removable bridge piece is constructed to engage slidably one standard and tilted to engage the other.

999,690. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed June 19, 1909. A regulating potential controls current in a field coil and the latter controls a battery current for starting and neutralizing without interrupting the main connections for opening any field circuit.



999,581.—Pressing Irons.

999,710. CONSTANT-TEMPERATURE BATH; T. B. Freas, Chicago, Ill. App. filed Sept. 1, 1909. One heater is controlled by the temperature of the bath itself and another independent heater is controlled by the temperature of the surrounding atmosphere.

999,719. ELECTRIC-FURNACE ELECTRODE; C. Hering, Philadelphia, Pa. App. filed July 6, 1909. Division from Patent No. 988,936. Claims an electrode of such length and uniform cross-section that substantially no heat will flow into or out of the furnace through the hot end of the electrode.

999,720. ELECTRIC FURNACE; C. Hering, Philadelphia, Pa. App. filed Feb. 17, 1911. Division from Patent No. 988,936. Molten conducting material serves as the resistor and the electrodes are so proportioned as to avoid heat loss by conduction through the electrodes.

Patent Issued July 25, 1911; Delayed in Receipt.

998,719. TELEPHONE SYSTEM; C. A. Simpson, Chicago, Ill. App. filed Nov. 30, 1908. Eliminates the cut-off relay and at the same time maintains the advantage of systems provided with both line and cut-off relays.